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BAKER (MICHAEL) JR INC BEAVER PA  
NATIONAL DAM SAFETY PROGRAM, BARBOUR MILL DAM (NJ-00237), PASSA--ETC(U)  
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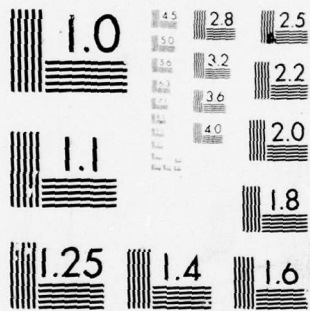
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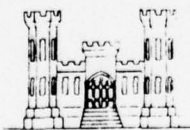
**LEVEL II**

# BARBOUR MILL DAM

## PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

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NJ 00237



DEPARTMENT OF THE ARMY  
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
CUSTOM HOUSE - 2D & CHESTNUT STREETS  
PHILADELPHIA, PENNSYLVANIA 19106  
AUGUST 1978

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NJ00237	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program Barbour Mill Dam Passaic County, N.J.		5. TYPE OF REPORT & PERIOD COVERED (9) FINAL report
7. AUTHOR(s) Michael Baker, III, P.E.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Michael Baker, Jr. Inc. 4301 Dutch Ridge Rd. Box 280 Beaver, Pa. 15009		8. CONTRACT OR GRANT NUMBER(s) 15 DACW61-78-C-141
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 6 National Dam Safety Program, Barbour Mill Dam (NJ-00237), Passaic River Basin, Breakneck Brook, Passaic County, New Jersey. Phase I Inspection Report.		12. REPORT DATE 12 August, 1978
		13. NUMBER OF PAGES 22
		15. SECURITY CLASS. (of this report) Unclassified
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES  Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dams--N.J. National Dam Safety Program Phase I Barbour Mill Dam, N.J. Dam Inspection Dam Safety		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		

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JCB



FINAL

Phase I Inspection Report  
National Dam Safety Program

U.S. Army Engineer District, Philadelphia  
Custom House, 24 & Chestnut Streets  
Philadelphia, Pennsylvania 19106

Unclassified

Approved for public release; distribution unlimited.

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22161.

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-507. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY  
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
CUSTOM HOUSE—2 D & CHESTNUT STREETS  
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO  
NAPEN-D

Honorable Brendan T. Byrne  
Governor of New Jersey  
Trenton, New Jersey 08621

19 SEP 1978

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Barbour Mill Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given on the first three pages of the report.

Based on visual inspection, available records, calculations and past operational performance, Barbour Mill Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. However, this dam does not have a spillway and the outlet works is inadequate to serve as a spillway in that 13 percent of the 100-year flood would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The design of an adequate spillway should be accomplished by a qualified professional consultant, engaged by the owner, using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Construction of the spillway should be initiated within calendar year 1979. In the interim, detailed emergency operation and evacuation plans and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. The following actions should be taken within the stated times from the date of approval of this report:

(1) Within three months one or more flashboards should be removed from the masonry arch culvert inlets. This will lower the pond level and provide additional storage capacity for flood flows until other modifications can be made to the dam.

NAPEN-D

Honorable Brendan T. Byrne

(2) Within six months the owner should patch the loose or open joints in the masonry of the two arch culverts.

(3) Within one year the owner should remove all heavy vegetation and replace it with low cover vegetation (grass) which should be mowed frequently.

(4) Within one year the owner should initiate a program of periodic inspection of the flashboards for deterioration and repair the flashboards as necessary.

(5) Within one year the owner should remove debris and obstructions from the downstream channel. Future periodic maintenance should routinely clean the channel.

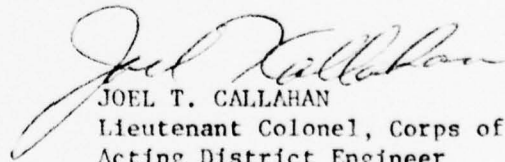
A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Robert A. Roe of the Eighth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia, 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely yours,

1 Incl  
As stated

  
JOEL T. CALLAHAN  
Lieutenant Colonel, Corps of Engineers  
Acting District Engineer

Cy furn:  
Mr. Dirk C. Hofman, P.E., Deputy Director  
Division of Water Resources  
N. J. Dept. of Environmental Protection  
P.O. Box 2809  
Trenton, NJ 08625

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BARBOUR MILL DAM (NJ00237)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 10 and 13 June 1978 by Michael Baker, Jr., Inc. Consulting Engineers, under contract to the U. S. Army Engineer District, Philadelphia, in accordance with the National Dam Inspection Act, Public Law 92-367.

The Barbour Mill Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be, in fair overall condition. However, this dam does not have a spillway and the outlet works is inadequate to serve as a spillway in that 13 percent of the 100-year flood would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The design of an adequate spillway should be accomplished by a qualified professional consultant, engaged by the owner, using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Construction of the spillway should be initiated within calendar year 1979. In the interim, detailed emergency operation and evacuation plans and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. The following actions should be taken within the stated times from the date of approval of this report:

(1) Within three months one or more flashboards should be removed from the masonry arch culvert inlets. This will lower the pond level and provide additional storage capacity for flood flows until other modifications can be made to the dam.

(2) Within six months the owner should patch the loose or open joints in the masonry of the two arch culverts.

(3) Within one year the owner should remove all heavy vegetation and replace it with low cover vegetation (grass) which should be mowed frequently.

(4) Within one year the owner should initiate a program of periodic inspection of the flashboards for deterioration and repair the flashboards as necessary.

(5) Within one year the owner should remove debris and obstructions from the downstream channel. Future periodic maintenance should routinely clean the channel.

APPROVED: Joel T. Callahan

JOEL T. CALLAHAN

Lieutenant Colonel, Corps of Engineers  
Acting District Engineer

DATE: 19 September 1978



PHASE I REPORT  
NATIONAL DAM SAFETY PROGRAM

Name of Dam - Barbour Mill Dam, Passaic County, New Jersey  
Stream - Unnamed Tributary of Preakness Brook  
Dates of Inspection - 10 and 13 June 1978

ASSESSMENT OF  
GENERAL CONDITIONS

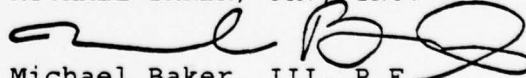
Barbour Mill Dam is an earth dam with a crest length of approximately 226 feet and a maximum height of about eight feet. Ownership of the dam, which impounds a pond with a volume of about 67 acre-feet at dam crest level, is presently in transition from Mr. Gary Van Decker to the Township of Wayne. The township is reportedly planning to develop a park including the pond and dam.

Visual inspection and review of engineering data in June 1978 indicate no serious deficiencies requiring emergency attention. The dam was found to be in fair overall condition at the time of inspection. However, certain items of rehabilitation should be performed including: removal of trees and shrubs and replanting with grass, periodic inspection and repair of flashboards, and cleaning and maintenance of the downstream channel.

The dam has four outlet conduits, but no spillway. Hydraulic/hydrologic evaluations performed in accordance with established Corps of Engineers procedures for Phase I Inspections revealed that the outlet conduits will not pass the 100 year flood without the dam being overtopped by 1.5 feet of water. A spillway is obviously required.

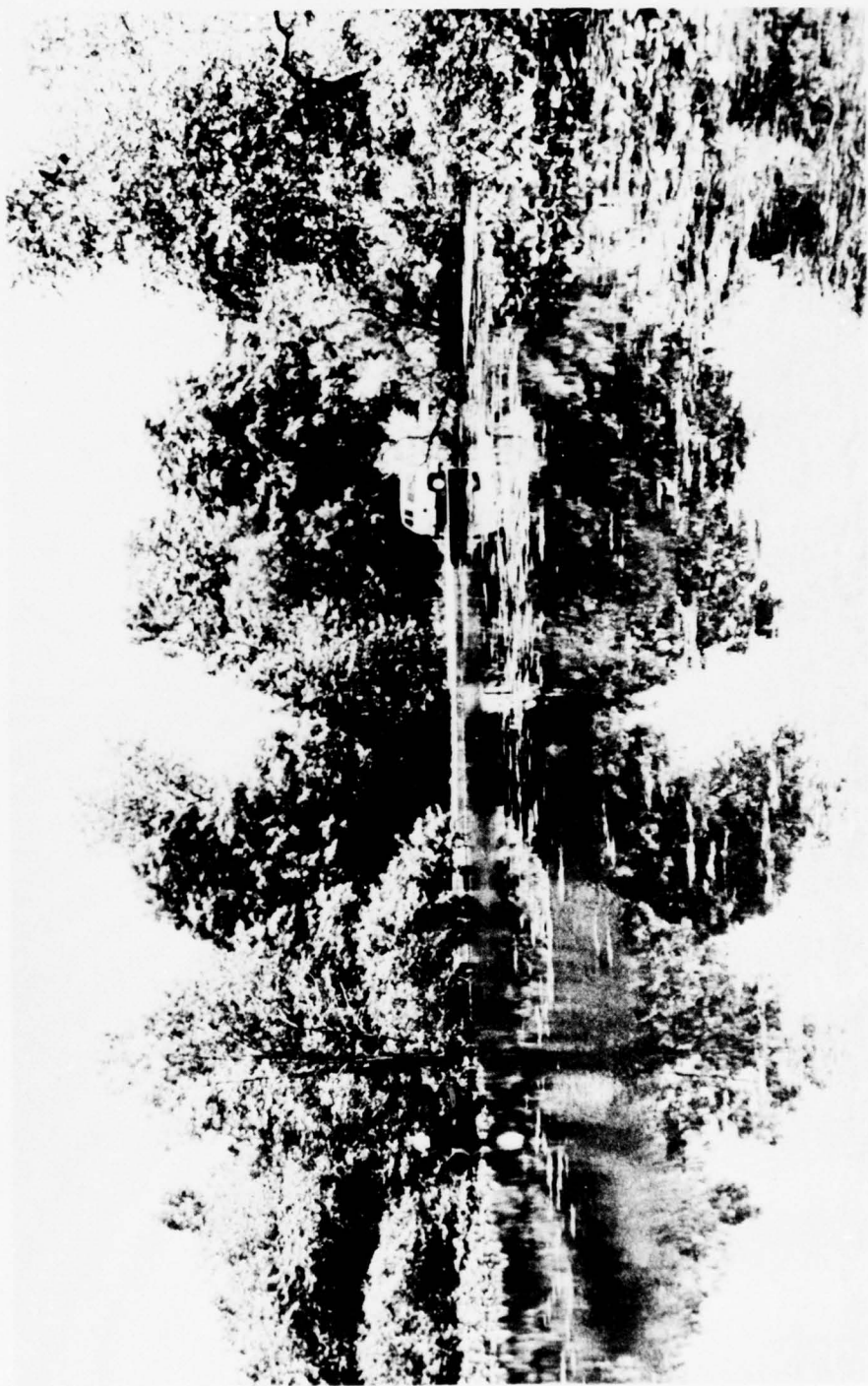
In view of the ownership transition and the presently uncertain role of the dam in future park development, it is recommended that the township initiate planning and engineering studies to clarify the future of the dam. If the dam is to be maintained as part of the park, the township should include a spillway along with whatever other modifications are made to the dam and park. As an interim measure, Mr. Van Decker and the township should remove one or more of the flashboards from the masonry arch culvert inlets to lower the pond level, thereby providing additional storage capacity for flood flows. Also, the loose or open joints in the masonry of the two arch culverts should be repaired.

MICHAEL BAKER, JR., INC.



Michael Baker, III, P.E.  
Chairman of the Board and  
Chief Executive Officer  
Registration Number 13385

NAME OF DAM: BARBOUR MILL DAM



OVERALL VIEW OF DAM

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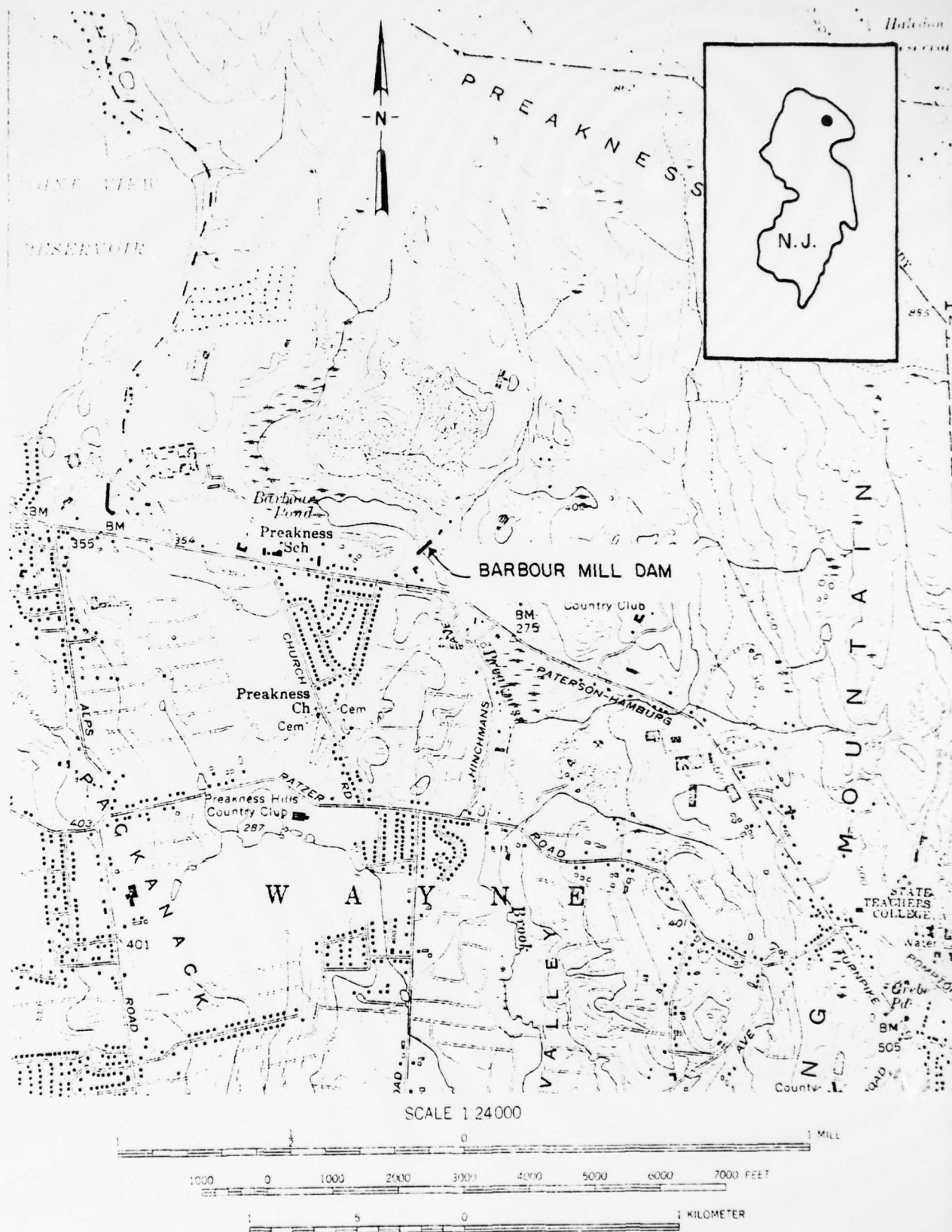
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NAME OF DAM: BARBOUR MILL DAM



LOCATION PLAN  
BARBOUR MILL DAM



PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM  
NAME OF DAM: BARBOUR MILL DAM, ID# NJ 00237

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

- a. Authority - This report is authorized by the National Dam Inspection Act, Public Law 92-367, 92nd Congress, H.R. 15951 enacted 8 August 1972 and has been prepared in accordance with Contract No. DACW61-78-C-0141 between Michael Baker, Jr., Inc., and the U.S. Army Corps of Engineers, Philadelphia District.
- b. Purpose of Inspection - The purpose of this inspection is to evaluate the general condition of Barbour Mill Dam with respect to safety of the facility based upon available data and visual inspection.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances - Barbour Mill Dam is a small, indistinct earth embankment with a crest length of approximately 226 feet and a maximum height of about eight feet. The indistinct nature of the embankment results from numerous modifications over the years, the most important of which appears to have been placement of considerable quantities of random fill downstream from the original dam in approximately 1950.

Very little historical information on Barbour Mill Dam is readily available. The original dam was apparently constructed sometime during the 1800's to impound water for a grist mill.

The earliest historical record of the dam in the files of the New Jersey Department of Environmental Protection (N.J.D.E.P.) is a file card on a dam inspection made 27 April 1922 by H. T. Critchlow. At that time, the dam was characterized as being associated with an abandoned mill, and the stream on which it is located was called Singac Brook. The dam was described on the file card as an earth embankment 250 feet long with a maximum height of eight feet and a roadway along its crest. The upstream slope was given as two horizontal to one vertical (2:1) and the downstream slope was a

NAME OF DAM: BARBOUR MILL DAM

vertical stone wall. In 1922, a "raceway" (presumably some type of mill race outlet conduit) with a gate three feet wide by five feet high was located at the right end of the dam and another outlet conduit of unspecified type with a sluice gate two feet wide by 6.5 feet high was located 60 feet from (i.e., probably left of) the right end of the dam. The top of this latter gate was apparently located two feet below the top of the embankment. It was noted on the file card that a 35 feet breach had occurred between the sluice gate and the right end of the dam in July 1919 and also that the dam "should have [a] spillway."

The only other N.J.D.E.P. file information on the dam is from 1946. Mr. John N. Brooks, Consulting Hydraulic Engineer (formerly with the New Jersey Department of Conservation) inspected the dam on 16 March 1946 on behalf of Mr. A. G. Simonds; Executor of the Estate of Charles W. Simonds, which owned the dam at that time. Mr. Brooks' dam inspection report indicates that in 1946 the dam was an earth embankment about 500 feet long with a maximum height of eight feet conveying a badly rutted farm road on its 14 feet wide crest. The dam had a rubble masonry wall downstream and a 1:1 upstream slope with a small amount of old riprap. Outlet works consisted of two arched top masonry conduits, one three feet wide discharging into the stream and one two feet wide discharging into the head race which served the former mill below (i.e., downstream from) the right end of the dam. The pond level was controlled by flashboards at the inlets of the masonry conduits. Mr. Brooks made several recommendations for upgrading the dam, chief of which was design and construction of a concrete spillway with a safe discharge capacity of 540 c.f.s. There is no indication that Mr. Brooks' recommendations were ever implemented.

The dam was acquired in 1950 by its present owner Mr. Gary Van Decker who has a large sand and gravel operation along the hillside north of the pond (Plate 1). Mr. Van Decker indicated that he filled in portions of the area downstream from the dam and constructed a concrete slab over the masonry arch outlet conduits in 1950. He also installed two 30 inch diameter corrugated metal outlet pipes in approximately 1975.

In a telephone conversation on 12 June 1978, Mr. Van Decker indicated that the Township of Wayne is in the process of acquiring Barbour Mill Dam and Barbour Pond, presumably for use as a park

NAME OF DAM: BARBOUR MILL DAM



and recreation area. He stated that the township presently owns about two-thirds of the pond; by 1981 the Township will own 100 feet around the pond; and by 1983 the Township will own the entire pond and dam. Additional details of this property transfer are unknown to Michael Baker, Jr., Inc., but it appears that the Township of Wayne will have a major responsibility for the future of the dam and pond.

This somewhat lengthy but nevertheless sketchy chronology of the dam was given above so that readers can better appreciate material presented subsequently in this report. The dam as it existed at the time of the inspection by Michael Baker, Jr., Inc. on 10 and 13 June 1978 is shown in field sketches (Plates 1, 2 and 3) and in the photographs (Overall View of Dam and Photos 1 through 12) included in this report.

As best Michael Baker, Jr., Inc. could determine in the field, the dam embankment has a crest length of approximately 226 feet and a maximum height of about eight feet. An access driveway extends along the crest which has a minimum width of approximately 20 feet. Both the upstream slope and the downstream slope of the embankment are ill defined. Except in the vicinity of the concrete head wall with the outlet conduits (described below), the upstream slope is largely covered with silt, muck and aquatic vegetation. The downstream slope is indistinct because of random fill placed by Mr. Van Decker (and perhaps by others), and the area immediately downstream from the dam is a nearly impenetrable jungle of trees, brush and other vegetation.

There is a concrete head wall with an overall length of about 62 feet at the right (southwest) end of the upstream side of the embankment. This head wall has a top width of about three feet, a straight central section about 36 feet long, and flared end sections containing the inlets of the two stone masonry arch culverts that comprise the principal outlet works for the dam (Plate 2). The larger masonry arch culvert at the left (northeast) end of the head wall has a cross-section about six feet wide by six feet high, and a five feet wide inlet controlled with wooden flashboards which extend down to pond bottom level. The smaller masonry arch culvert on the right (southwest) end of the head wall has a cross-section about three feet wide by two feet high, and its inlet is also

NAME OF DAM: BARBOUR MILL DAM

controlled with wooden flashboards. Flashboards in the inlet of the small masonry arch culvert do not extend all the way to pond bottom level. The date of head wall construction is unknown, but it is surmised to have been constructed in the late 1940's or early 1950's.

In addition to the two masonry arch culverts, there are two 30 inch diameter corrugated metal pipes located some 20 feet left of the large masonry culvert (Plate 2). These pipes were reportedly installed by Mr. Van Decker in 1975. The pond level (controlled by flashboards in the masonry arch culvert inlets) was essentially at inlet invert level of the corrugated metal pipes at the time of inspection. Pipe inlet levels are such that the depth of water flow through the pipes will be only about 0.9 foot when the dam is overtopped at a low point on the embankment crest approximately 35 feet left (northeast) of the pipes and also at a low point near the center of the concrete head wall.

Discharge from the corrugated metal pipes flows into the outlet channel for the large masonry arch culvert, and this channel joins the outlet channel for the small masonry arch culvert at a point about 70 feet downstream from the concrete head wall in densely vegetated random fill (Plate 2). From that point, the discharge channel extends about 300 feet further downstream to a bridge from Valley Road to the parking area of the Suburban Savings and Loan Building (Plate 1). This bridge has a clear opening, twelve feet wide by five feet high. Water backed up at the bridge would flow easterly onto Valley Road before overtopping the bridge. A new culvert across Valley Road downstream from this bridge was under construction in June 1978 (Plate 1).

Barbour Pond, which has extensive deposits of silt and muck as well as abundant aquatic vegetation, is rapidly evolving into a swamp (Plate 1). The maximum depth of pond water at the time of inspection was about seven feet at the concrete head wall, and the average depth of pond water was estimated to have been about three feet.

- b. Location - Barbour Mill Dam is located on an unnamed tributary of Preakness Brook in Wayne Township, Passaic County, New Jersey. The dam is located about four miles north of Interstate

NAME OF DAM: BARBOUR MILL DAM

Route 80 and approximately 700 feet northwest of the intersection of the Paterson-Hamburg Turnpike and Valley Road. Access to the dam from Valley Road is provided by an unpaved driveway which extends along the crest of the dam.

- c. Size Classification - The maximum height of the dam is approximately eight feet. Calculations indicate that pond volume to the top of dam is approximately 67 acre-feet. The dam is therefore in the "Small" size category as defined by the "Recommended Guidelines for Safety Inspection of Dams."
- d. Hazard Classification - The downstream channel passes beneath Valley Road and the Paterson-Hamburg Turnpike, both of which are heavily travelled. In addition, there is a shopping center south of the Turnpike and other commercial buildings along the reach of Preakness Brook downstream from the shopping center. In the event of failure of the dam, an "appreciable" economic loss would occur; but the loss of life would certainly not exceed a "few," if indeed any lives were lost at all. The dam is therefore considered to be in the "Significant" hazard category as defined in the "Recommended Guidelines for Safety Inspection of Dams."
- e. Ownership - The dam is owned by Mr. Gary Van Decker, 1501 Valley Road, Wayne, New Jersey 07470.
- f. Purpose of Dam - Barbour Pond presently serves as a sediment and storm water retention basin for its watershed. The pond is also used for recreational activities to a limited extent. As indicated in paragraph 1.2.a., the Township of Wayne is acquiring the pond and dam for development as a park and recreation area.
- g. Design and Construction History - All readily available information on the design and construction of Barbour Mill Dam was summarized in paragraph 1.2.a.
- h. Normal Operational Procedures - During periods of heavy rainfall, Mr. Gary Van Decker visits the dam and removes flashboards, if necessary, to reduce the potential for overtopping of the dam.

NAME OF DAM: BARBOUR MILL DAM

### 1.3 PERTINENT DATA

- a. Drainage Area - The drainage area of Barbour Pond is 0.9 square mile.
- b. Discharge at Damsite - The maximum known flow at the damsite is unknown to Michael Baker, Jr., Inc. In the report on his 1946 dam inspection (paragraph 1.2.a.), Mr. John N. Brooks estimated the peak flow at the dam to have been approximately 270 c.f.s. during a severe storm which occurred in Northern New Jersey in July 1945. This estimated peak discharge may be of value for reference purposes.
- c. Elevation [feet above Mean Sea Level (M.S.L.)] -
  - Top of Dam - 281.9
  - Maximum Pool (Design Discharge) - Not available
  - Normal Pool - 281.0
  - Streambed at Centerline of Dam - 274.5+
  - Normal Tailwater - 274.8

Note: No surveyed elevation data on Barbour Mill Dam and Pond were available. The U.S. Geological Survey Paterson 7.5 Minute Topographic Quadrangle was used to estimate a pond water elevation of 281.0 at the time of inspection. Field measurements indicated that the low points on dam crest were 0.9 foot above pond level. The inferred minimum dam crest elevation of 281.9 was used as a bench mark, and other elevations were determined by hand leveling or direct measurement. Hence, all elevations given in this report are based on an inferred minimum dam crest elevation of 281.9 M.S.L.

- d. Reservoir (feet) -
  - Length of Maximum Pool - Not available
  - Length of Normal Pool - 1900
- e. Storage (acre-feet) -
  - At Top of Dam (El. 281.9) - 67
  - At Spillway Crest (El. 280.8) - 50
- f. Reservoir Surface (acres) -
  - Top of Dam - 16
  - Spillway Crest - 14

NAME OF DAM: BARBOUR MILL DAM



g. Dam -

Type - Earthfill

Length - 226 feet

Height - Eight feet

Top Width - 20 feet (minimum)

Side Slopes - Upstream - Cannot be determined due  
to shallow water and aquatic  
vegetation.

Downstream - Cannot be determined due to  
random fill and heavy  
vegetation.

Impervious Core - No information available

Cutoff - No information available

h. Diversion and Regulating Tunnel - None

i. Spillway -

Type - Two stone masonry arch culverts with wood flash-  
boards at inlets (plus two 30 inch diameter  
corrugated metal pipes with only 0.9 foot head-  
water potential)

Length of Weir - 8.2 feet (total)

Crest Elevation - 280.8 feet (M.S.L.)

Gates - None

Downstream Channel - Heavily vegetated stream banks for  
about 70 feet, then well kept  
grass banks.

j. Regulating Outlets - Manual operation by placing and  
removing flashboards

NAME OF DAM: BARBOUR MILL DAM

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

No design data were available for review. All pertinent information from the files of the N.J.D.E.P. was summarized in paragraph 1.2.a.

### 2.2 CONSTRUCTION

All readily available construction information was summarized in paragraph 1.2.a.

### 2.3 OPERATION

Mr. Gary Van Decker, the present owner, is responsible for operation and maintenance of the dam. There are no operational records available for review.

### 2.4 EVALUATION

As indicated previously in this report, very little background information was available on Barbour Mill Dam and Barbour Pond. In view of the history and size of the dam and pond, the readily available background information and observations made during the field inspection are considered sufficient for purposes of this Phase I Inspection Report.

NAME OF DAM: BARBOUR MILL DAM



## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

- a. General - The dam and its appurtenant structures were found to be in fair overall condition at the time of inspection. The problems noted during the visual inspection are considered minor and do not require immediate remedial treatment. Noteworthy deficiencies observed are described briefly in the following paragraphs. The complete visual inspection check list is given in Appendix A. Field sketches are included as Plates 1, 2 and 3.
- b. Dam - As indicated in paragraph 1.2.a., the area downstream from the original dam now consists of random fill and debris with heavy vegetation.  
  
A minor seepage area was observed at the base of the left side of the large masonry arch culvert outlet. An estimated one to two g.p.m. of clear water was flowing from the well graded granular soil fill approximately 1.5 feet above tailwater elevation.
- c. Appurtenant Structures - The stones in the masonry arch culverts, especially near the inlets, have open joints and may be loose. The inverts of the two 30 inch corrugated metal pipe culvert inlets are essentially at normal pool elevation. These culverts will not pass any appreciable flow until the pond level rises due to heavy rainfall. At that point, the maximum depth of flow through the corrugated metal pipe culverts without overtopping the dam is only about 0.9 foot.
- d. Reservoir Area - Pond storage volume has been significantly reduced by sediment and aquatic vegetation.
- e. Downstream Channel - The portion of outlet channel extending approximately 70 feet downstream from the dam is partially obstructed by trash, natural debris, brush, trees and weeds. Further downstream, the channel is well maintained with grassed slopes. A driveway bridge with a clear opening 12 feet wide by five feet high is located approximately 400 feet downstream from the dam.

NAME OF DAM: BARBOUR MILL DAM

### 3.2 EVALUATION

- a. Dam - The area of minor seepage at the left side of the large masonry arch culvert outlet is considered insignificant since indications of piping (internal erosion) were not observed. The dam has a very low head and hydraulic gradient. The embankment fill in the seepage area is a well graded granular soil. The dam should be cleared of heavy vegetation and replanted with low cover vegetation (grass) and mowed as necessary.
- b. Appurtenant Structures - The joints in the masonry arch culverts should be patched if the life of the dam is to be extended. The flashboards at the inlets should be inspected periodically for deterioration and repaired as necessary.
- c. Reservoir Area - The pond is turning into a swamp. As indicated in paragraph 1.2.a., Wayne Township is acquiring the dam and pond for use as a park and recreation area. Township plans for the area are unknown at this time. However, Michael Baker, Jr., Inc. suggests that the township consider dredging and vegetation control programs if the life of the pond is to be extended, or if the pond is to be upgraded for recreational use.
- d. Downstream Channel - The channel extending 70 feet downstream from the dam should be cleaned of obstructions and debris. This channel should be cleaned in the future as routine maintenance of the dam.

NAME OF DAM: BARBOUR MILL DAM

## SECTION 4 - OPERATIONAL PROCEDURES

### 4.1 PROCEDURES

Operational procedures are generally discussed in paragraphs 1.2.h. and 2.3.

There are no formal emergency procedures in the event of impending catastrophe for the dam. During periods of heavy rainfall, Mr. Gary Van Decker, the present owner, will presumably visit the dam and remove flashboards, as necessary to reduce the potential for overtopping of the dam. Rapid emergency drawdown of the pond could be accomplished by removal of flashboards at the inlets of the masonry arch culverts. Formal emergency procedures are not considered necessary for this dam because of its low height, small storage volume, and low degree of downstream flood hazard.

### 4.2 MAINTENANCE OF DAM AND APPURTENANCES

Mr. Van Decker is responsible for maintenance of the dam and its appurtenances. There do not appear to be any formal procedures for maintenance of these facilities.

### 4.3 EVALUATION

In view of the dam, its impoundment characteristics, and the pending transfer of ownership from Mr. Van Decker to the township; the present operational and maintenance procedures are considered adequate. Michael Baker, Jr., Inc. anticipates that operation and maintenance procedures will be upgraded after the transfer of ownership is completed and the township develops the area for recreational purposes.

NAME OF DAM: BARBOUR MILL DAM

## SECTION 5 - HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

- a. Design Data - There were no design data available for review and evaluation.
- b. Experience Data - Experience data from the files of the N.J.D.E.P. were summarized in paragraphs 1.2.a. and 1.3.b. No other experience data are readily available.
- c. Visual Observations - Field inspection disclosed a significant reduction in pond storage capacity due to sediment and aquatic vegetation, but no apparent deficiency in normal hydraulic functioning of the facilities.
- d. Overtopping Potential - Barbour Mill Dam is classified as a "Significant" hazard-"Small" size dam. According to the "Recommended Guidelines for Safety Inspection of Dams," this classification requires evaluation for a Spillway Design Flood (S.D.F.) ranging from the 100 year storm to one-half of the Probable Maximum Flood (P.M.F.). In view of the dam, impoundment, and downstream characteristics; the 100 year storm is considered to be sufficient as the S.D.F. for Barbour Mill Dam.

Outlet works for Barbour Mill Dam were described in paragraphs 1.2.a. and 1.3.i. of this report. Rating curves for the two masonry arch culverts were developed on the basis of sharp crested weir flow over the flashboards. Discharge ratings for the two corrugated metal pipe culverts were developed on the basis of inlet control and discharge ratings for low segments of the dam crest (at the concrete head wall and approximately 40 feet left of the corrugated metal pipe culverts) were developed on the basis of broad crested weir flow. Dimensions of outlet facilities were obtained from field measurements. Calculations indicated a total discharge capacity of approximately 79 c.f.s. with water level at the elevation of the low points in the dam crest.

Hydrologic analyses were done using the Flood Hydrograph Computer Package HEC-1 developed by the U.S. Army Corps of Engineers, and procedures outlined in the U.S. Bureau of Reclamation book Design of Small Dams. The rainfall depth was obtained from Technical Paper 40 by the U.S. Weather Bureau.

NAME OF DAM: BARBOUR MILL POND



Using the flood routing option of HEC-1 and the other procedures, assumptions, etc. described above; discharge from the 100 year storm was routed through the pond and found to overtop low portions of the dam crest by approximately 1.5 feet. Collectively, the spillways can pass approximately 12 percent of the 100 year flood. Therefore, the dam does not meet spillway criteria given in the "Recommended Guidelines for Safety Inspection of Dams."

The conclusions presented in this Phase I Inspection Report pertain to present conditions, and the effect of future development on the hydrology has not been considered.

- e. Emergency Drawdown - As indicated in paragraph 1.2.a., wooden flashboards at the inlet of the large masonry arch culvert extend to pond bottom level. Drawdown of the pond can be accomplished by removing all of these flashboards. Assuming simultaneous removal of all flashboards and neglecting pond inflow, calculations indicate that the pond could be drained in about one day.

NAME OF DAM: BARBOUR MILL DAM

## SECTION 6 - STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observations - No structural inadequacies were noted during the visual inspection of the dam.
- b. Design and Construction Data - Readily available historical information on the dam was summarized in paragraph 1.2.a. It is unlikely that a stability analysis has ever been performed for the dam and Michael Baker, Jr., Inc. can see no need for such an analysis at this time. In view of the minimal heights and modest inclinations of the dam slopes, the buttressing effects of upstream sediment and downstream random fill, and the fact that no indications of instability were observed during the field inspections of 10 and 13 June 1978; no further stability assessments are necessary for this Phase I Inspection Report.
- c. Operating Records - Nothing in the readily available operating information indicates cause for concern relative to structural stability of the dam.
- d. Post-Construction Changes - Readily available information on post-construction changes to the dam indicates that all such changes tended to improve structural stability.
- e. Seismic Stability - The dam is located in Zone 1 on the Seismic Zone Map of the Contiguous United States, Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is an area of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if they have adequate stability under static loading conditions. For the reasons outlined in paragraph 6.1.b., no further considerations of structural stability are necessary in this report.

NAME OF DAM: BARBOUR MILL DAM

## SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

- a. Safety - There are no findings, as a result of conditions observed during visual inspections on 10 and 13 June 1978, by which a detrimental assessment of the structural stability of Barbour Mill Dam can be rendered; provided the dam is not overtopped by flood waters. The hydraulic/hydrologic analysis performed in accordance with Corps of Engineers procedures for Phase I Inspections (paragraph 5.1.d.) has indicated that the outlet works of Barbour Mill Dam are inadequate to pass the 100 year flood without the dam being overtopped by about 1.5 feet of water.
- b. Adequacy of Information - As indicated in paragraph 2.4, the readily available background information and observations made during field inspection are considered adequate for this Phase I Inspection Report.
- c. Urgency - The dam does not require urgent remedial work.
- d. Necessity for Further Investigation - The hydraulic/hydrologic analysis performed in connection with this Phase I Inspection Report has indicated the need for a spillway. In view of the present transition of dam and pond ownership from Mr. Gary Van Decker to the Township of Wayne and the township's apparent intention of developing the area for recreational use, Michael Baker, Jr., Inc. believes that the township should initiate planning and engineering studies relative to the future role of the dam and pond in the recreational area. If the dam is to be maintained as part of a recreational area, then the township should include a spillway with whatever other modifications are to be made to the dam and pond.

### 7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed several items of rehabilitation and remedial work which should be performed by the dam owner. In view of the ownership transition described previously in this report, it is suggested that Mr. Gary Van Decker (present owner), the Township of Wayne (future owner), and other governmental agencies as necessary coordinate their efforts in order to achieve maximum efficiency and economy in this work.

NAME OF DAM: BARBOUR MILL DAM

If the life of the dam is to be extended, a spillway is certainly required. The Township of Wayne should address this point in developing plans for future development of the proposed recreational area in the vicinity of the dam.

As an interim measure, it is strongly recommended that one or more flashboards be removed very soon from the masonry arch culvert inlets. This will lower the pond level and provide additional storage capacity for flood flows until other modifications can be made to the dam.

If the useful lives of these culverts are to be extended, the present or future owner of the dam should patch the loose or open joints in the masonry of the two arch culverts soon.

The dam inspection also disclosed several items of lower priority which should be performed in the near future by the present owner. These include:

- 1) Removal of all heavy vegetation and replacement with low cover vegetation (grass) which should be mowed frequently.
- 2) Periodic inspection of the flashboards for deterioration and repair of the flashboards as necessary.
- 3) Removal of debris and obstructions from the downstream channel. Future periodic maintenance should routinely clean the channel.

NAME OF DAM: BARBOUR MILL DAM



PLATES

MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

Subject Barbour Mill Dam  
Wayne Township, NJ  
Overall Plan Sketch

Computed by JH Checked by \_\_\_\_\_

S.O. No. 13143-01-ARA

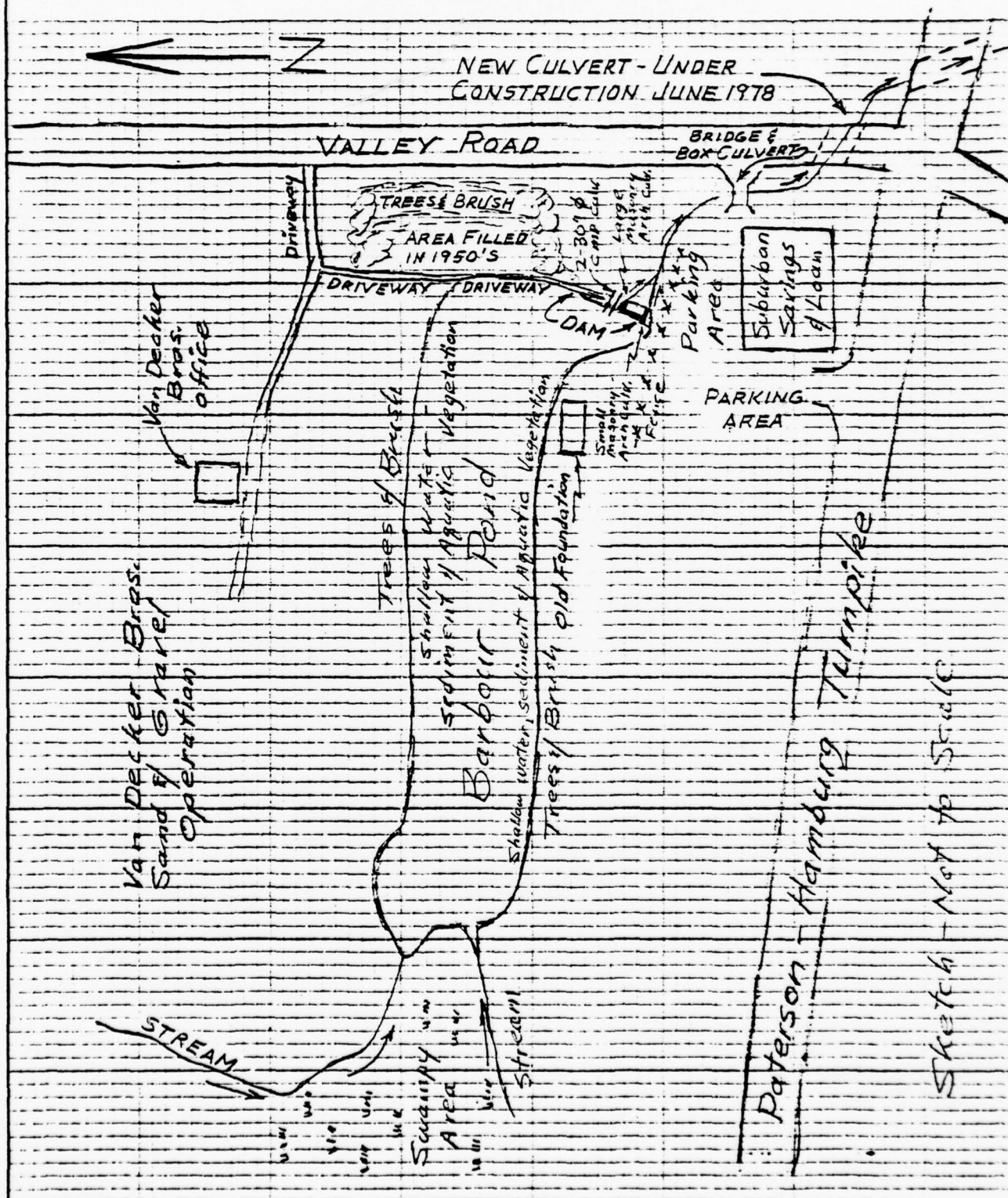
Sheet No. \_\_\_\_\_ of \_\_\_\_\_

Drawing No. 1

Date 8-2-78

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PLATE 1



MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280

Beaver, Pa. 15009

Subject Barbour Mill Dam

S.O. No. 1343-01-ARA

Wayne Township, NJ

Sheet No. \_\_\_\_\_ of \_\_\_\_\_

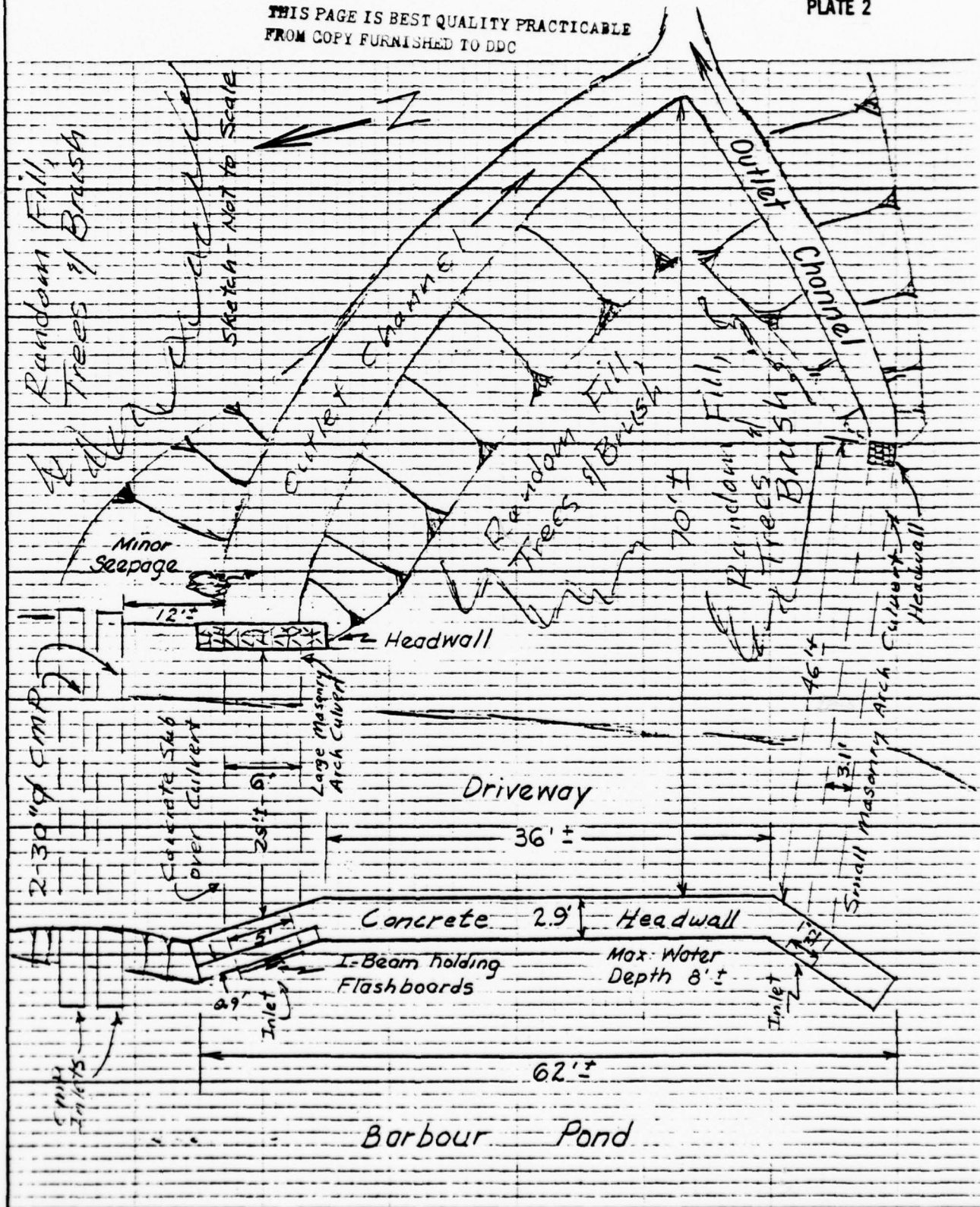
Outlet Works Plan Sketch

Drawing No. 2

Computed by JKH Checked by \_\_\_\_\_ Date 8-2-78

PLATE 2

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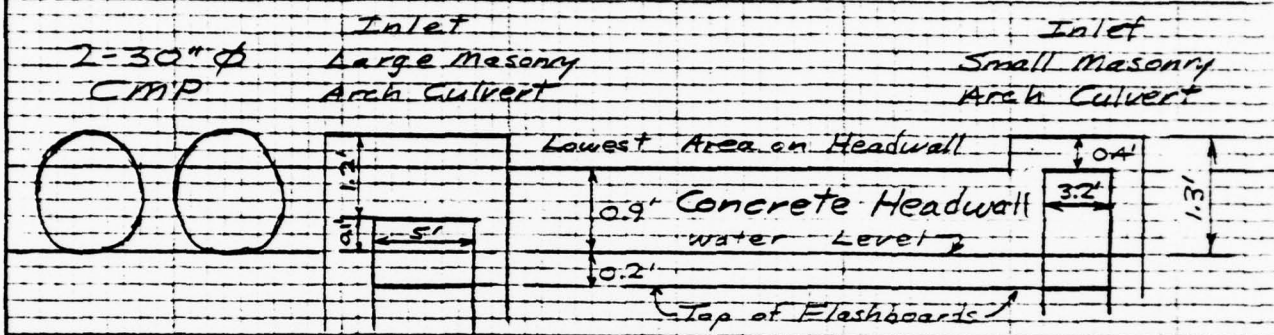
MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

Subject Barbour Mill Dam S.O. No. 13143-01-ARA  
Wayne Township, N.J. Sheet No.      of       
Outlets - Elevation Sketches Drawing No. 3  
Computed by JKH Checked by      Date 8-2-78

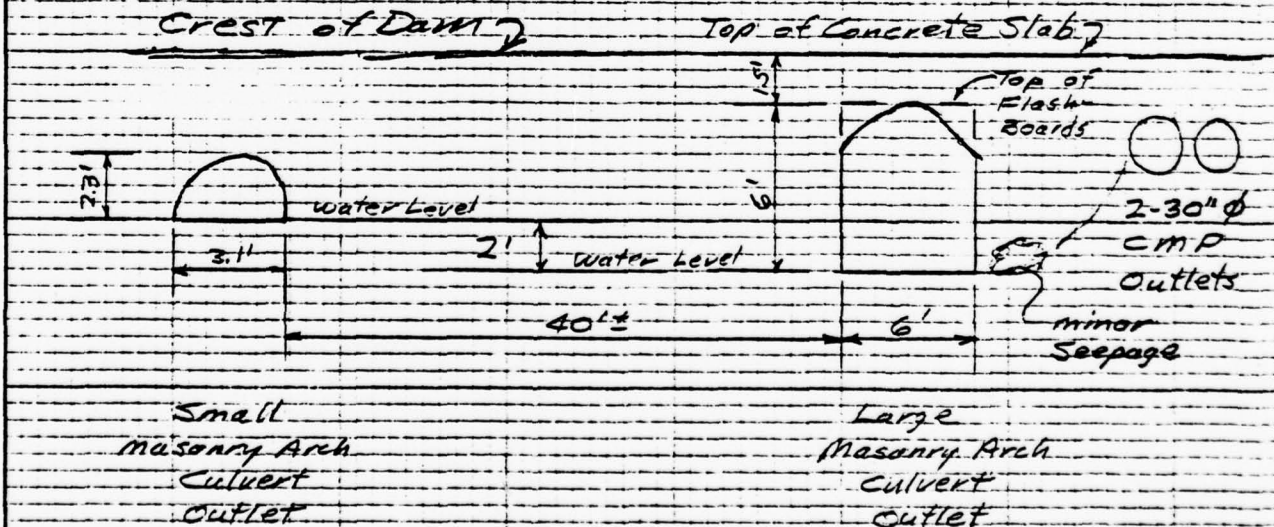
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PLATE 3



Low Point on Embankment = 0.9' Free board as at Headwall - is approx 35' left of 30"  $\phi$  CMP.

### UPSTREAM ELEVATION



### DOWNSTREAM ELEVATION

Sketches - Not to Scale



PHOTOGRAPHS

#### DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam - View East at Upstream Side of Dam From Right (South) Bank of Pond About 200 Feet Upstream From Dam; E. U. Gingrich Standing in Left Side of Photo at Inlet of Two 30 Inch Corrugated Metal Pipe Culverts (Photo 4 and 10); Concrete Head Wall with Masonry Arch Culvert Inlets in Center of Photo; Station Wagon on Right Abutment of Dam Above Inlet of Small Masonry Arch Culvert (Photo 6) - 10 June 1978

- Photo 1 View Southwest Along Driveway (From Valley Road, Photo 8) on Crest of Dam; J. V. Hamel Standing at Inferred Left (Northeast) End of Dam Embankment; Suburban Savings and Loan Parking Area (Photo 7) in Top Center of Photo Beyond Outlet Works Portion of Dam - 13 June 1978.
- Photo 2 - View Northeast Along Crest of Dam From Right (Southwest) Abutment (Adjacent to Suburban Savings and Loan Parking Area, Photo 1); J. V. Hamel Standing at Inferred Left (Northeast) End of Dam Embankment; Concrete Head Wall with Masonry Arch Culvert Inlets in Bottom Left Corner of Photo - 13 June 1978.
- Photo 3 - View East-Northeast at T. J. Dougan in "Jungle and Random Fill" Area Downstream From Center of Dam About 50 Feet Northeast of Two 30 Inch Corrugated Metal Pipe Culverts (Photo 4) - 13 June 1978.
- Photo 4 - Close-Up of Outlet Ends of Two 30 Inch Corrugated Metal Pipe Culverts (Left Side of Overall View of Dam) in Downstream Slope of Dam Embankment - 10 June 1978.
- Photo 5 - Outlet of Large Masonry Arch Culvert; Rule is Folded One Foot by Five Feet for Scale; Drop Inlet Visible at Upstream End of Culvert; Minor Seepage From Masonry Wall at Geologists Hammer in Lower Right Corner of Photo - 10 June 1978.
- Photo 6 - Outlet of Small Masonry Arch Culvert at Right (Southeast) End of Dam; Geologists Hammer for Scale - 10 June 1978.
- Photo 7 - View Upstream (Northwest) Along Outlet Channel From Dam; Dam Is Behind Trees in Center of Photo; Suburban Savings and Loan Parking Area (Photo 1) at Left Edge of Photo - 13 June 1978.

NAME OF DAM: BARBOUR MILL DAM

- Photo 8 - View North From Same Location as Photo 7; Dam Is Behind Trees in Left Side of Photo; Outlet Channel From Dam Is in Bottom Left Corner of Photo; Valley Road Is at Right Edge of Photo - 13 June 1978.
- Photo 9 - View North at Concrete Head Wall Inlet of Large Masonry Arch Culvert Showing I-Beam Support and Top of Flashboards; Two Feet Rule Section at Inlet for Scale - 10 June 1978
- Photo 10 - View Southwest at Inlet Ends of Two 30 Inch Corrugated Metal Pipe Culverts. Inlets Were Installed With Invert Elevation 0.2 Foot Above Normal Pool Elevation; Maximum Depth of Flow in Pipes Is 0.9 Foot Before Dam Is Overtopped; Local Fisherman for Scale - 10 June 1978.
- Photo 11 - View Northwest at Outlet of Large Masonry Arch Culvert (Left Side of Photo) and Outlets of Two 30 Inch Corrugated Metal Pipes. (Top Right Corner of Photo, Behind Tree) - 10 June 1978.
- Photo 12 - View South Along Downstream Channel Showing Bridge to Suburban Savings and Loan Parking Area. Bridge, Which Spans Box Culvert Twelve Feet Wide by Five Feet High; Is Located Approximately 400 Feet Downstream From Dam - 10 June 1978.

NAME OF DAM: BARBOUR MILL DAM



**PHOTO 1**



**PHOTO 2**





PHOTO 3

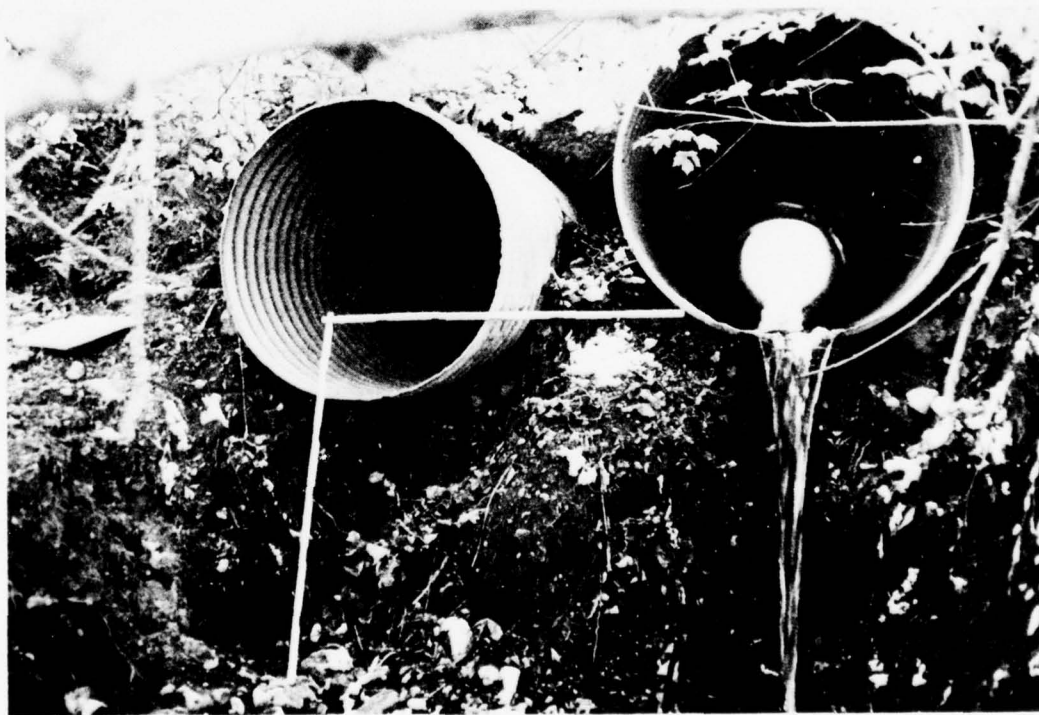


PHOTO 4



PHOTO 5



PHOTO 6



PHOTO 7



PHOTO 8



PHOTO 9



PHOTO 10





PHOTO 11



PHOTO 12

APPENDIX A

CHECK LIST - VISUAL INSPECTION

Check List  
Visual Inspection  
Phase 1

Name Dam Barbour Mill Dam County Passaic State New Jersey Coordinates Lat. 40° 57.6'  
Long. 74° 13.6'

Dates Inspection 10 June 1978 and 13 June 1978 Weather Sunny and Cloudy Temperature 80°F. and 70°F.

Pool Elevation at Time of Inspection 281<sup>+</sup> M.S.L. Tailwater at Time of Inspection 274.8<sup>+</sup> M.S.L.

<sup>4</sup> Pool elevation was determined from U.S.G.S. Paterson, New Jersey 7.5 Minute Topographic Quadrangle. This pool elevation was used as the reference elevation for Phase I Inspection.

Inspection Personnel:

MICHAEL BAKER, JR., INC.:

E. U. Gingrich  
T. J. Dougan  
J. V. Hame1

The owner did not accompany the inspection team during the inspection of the dam.

J. V. Hame1 Recorder

CONCRETE HEAD WALL OF STONE MASONRY ARCH CULVERTS

Barbour Mill Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	None were observed.	
STRUCTURAL CRACKING	None were observed.	
VERTICAL AND HORIZONTAL ALIGNMENT	No problems were observed.	
MONOLITH JOINTS	There are no monolith joints in the concrete head wall.	
CONSTRUCTION JOINTS	There are none.	



Barbour Mill Dam  
CONCRETE HEAD WALL OF STONE MASONRY ARCH CULVERTS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON "EMBANKMENT", Sheet 2, Subheading on "ANY NOTICEABLE SEEPAGE"		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No problems were observed.	
45		
DRAINS	There are none.	
WATER PASSAGES	There are none.	
FOUNDATION	The foundation is not exposed. Therefore, the inspection could not determine whether foundation is glacial soil or rock.	

EMBANKMENT

Barbour Mill Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NOTE: There is no embankment as such. Area approximately 200 feet long from the inferred left (northeast) end of the original dam. Southwest to northeast end of concrete section was filled in by Mr. Van Decker 20 years ago. This area now consists of random fill, debris and jungle.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None were observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None were observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No problems were noted.	
RIPRAP FAILURES	There is no riprap.	

EMBANKMENT

Barbour Mill Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

JUNCTION OF EMBANKMENT  
AND ABUTMENT, SPILLWAY  
AND DAM

No problems were observed.

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ANY NOTICEABLE SEEPAGE

There is an estimated flow of one to two g.p.m.  
of clear water from fill at left side of left  
arch culvert outlet, approximately 1.5 feet  
above tailwater.

This leakage is considered insignificant:  
no indications of piping (internal  
erosion), low head and low hydraulic  
gradient, and well graded granular fill.

STAFF GAGE AND RECORDER

There are none.

DRAINS

There are none.

# OUTLET WORKS

Barbour Mill Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	There are no concrete surfaces. However, there are stone masonry walls with brick crowns in both arch culverts. Also, there are two 30 inch corrugated metal pipe culverts.	Patch open joints in masonry, if life of dam is to be extended significantly.
INTAKE STRUCTURE	Wooden flashboards on weir inlets may rot or deteriorate with time.	Periodic observation and maintenance of flashboards.
OUTLET STRUCTURE	There are some open joints in outlet ends of the two masonry arch culverts.	Patch open joints in masonry, if life of dam to be extended significantly.
OUTLET CHANNEL	Partly filled and obstructed with trash, natural debris, brush, trees and weeds.	Remove debris, etc. and clean up channel.
EMERGENCY GATE	There are no gates.	



Barbour Mill Dam

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONCRETE WEIR	NOTE: Inlets to two stone masonry arch culverts function as ungated spillways. See sheet on "OUTLET WORKS".	
---------------	---	--

APPROACH CHANNEL	There is none.	
------------------	----------------	--

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DISCHARGE CHANNEL	See Sheet on "OUTLET WORKS".	
-------------------	------------------------------	--

BRIDGE AND PIERS	There are none.	
------------------	-----------------	--

**GATED SPILLWAY**

Barbour Mill Dam

<b>VISUAL EXAMINATION OF</b>	<b>OBSERVATIONS</b>	<b>REMARKS OR RECOMMENDATIONS</b>
<b>CONCRETE SILL</b>	Not Applicable	
<b>APPROACH CHANNEL</b>	Not Applicable	
<b>DISCHARGE CHANNEL</b>	Not Applicable	
<b>BRIDGE AND PIERS</b>	Not Applicable	
<b>GATES AND OPERATION EQUIPMENT</b>	Not Applicable	

# INSTRUMENTATION

Barbour Mill Dam

## REMARKS OR RECOMMENDATIONS

## OBSERVATIONS

## VISUAL EXAMINATION

Not Applicable

## MONUMENTATION/SURVEYS

Not Applicable

## OBSERVATION WELLS

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Not Applicable

## WEIRS

Not Applicable

## PIEZOMETERS

Not Applicable

## OTHER

# RESERVOIR

Barbour Mill Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes of the reservoir are all flat and well vegetated.	
SEDIMENTATION	Most of the pond is silted with extensive vegetation; the pond is turning into swamp.	



# DOWNSTREAM CHANNEL

Barbour Mill Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Debris and vegetation is present in discharge channel from dam extending approximately 75 feet downstream from dam. The downstream channel is well maintained and stable beyond the first 75 feet of channel. Bridge with twelve feet wide by five feet high clear opening spans the downstream channel approximately 400 feet downstream from dam.	
SLOPES	The slopes of the downstream channel are approximately 2:1, well maintained and stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Outlet from dam joins Preakness Brook at intersection of Valley Road and Paterson-Hamburg Turnpike. Preakness Brook flows southeast along northeast edge of Wayne Mall Shopping Center to swampy area southeast of mall. There is adequate channel capacity for high flood flows from Barbour Pond watershed (by visual observation). New culvert being installed across Valley Road extension north of Paterson-Hamburg Turnpike. Construction of this culvert was not complete at the time of inspection; therefore, the size could not be determined. It is estimated that the culvert will have sufficient capacity based upon visual observation of the completed portion. No homes in affected areas.	

APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION

Barbour Mill Dam

ITEM	REMARKS
PLAN OF DAM	None were available.
REGIONAL VICINITY MAP	See portion of Paterson, New Jersey 7.5 Minute Topographic Quadrangle included as Location Plan in this report.
CONSTRUCTION HISTORY	The dam was constructed sometime prior to 1919. Visual inspection by the state was done 27 April 1922.
TYPICAL SECTIONS OF DAM	None were available.
HYDROLOGIC/HYDRAULIC DATA	None were available.
OUTLETS - PLAN	None were available.
- DETAILS	None were available.
- CONSTRAINTS	None were available.
- DISCHARGE RATINGS	None were available.
RAINFALL/RESERVOIR RECORDS	None were available.

Barbour Mill Dam

ITEM	REMARKS
DESIGN REPORTS	None were available.
GEOLOGY REPORTS	None were available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None were available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None were available.
POST-CONSTRUCTION SURVEYS OF DAM	None were available.
BORROW SOURCES	None were available.



# Barbour Mill Dam

ITEM	REMARKS
------	---------

MONITORING SYSTEMS      There are none.

MODIFICATIONS      Letters in New Jersey State ID 23-11 file indicate some modifications were performed in 1946, however, details on the specific modifications performed are not included. Discussion with Mr. Gary Van Decker, present owner, indicated the area downstream of earth embankment section was filled in with random material in approximately 1950. This area is relatively level now between previous earth embankment section and present Valley Road.

HIGH POOL RECORDS      None were available.

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POST-CONSTRUCTION ENGINEERING      Visual inspection on 27 April 1922 by State personnel recommended spillway for dam.  
STUDIES AND REPORTS      Visual inspection on 16 March 1946 by John N. Brooks, consulting hydraulic engineer, made several recommendations for renovations of dam, including the construction of a spillway for the dam. However, the recommendations were never implemented. Report available in the state file.

PRIOR ACCIDENTS OR FAILURE OF DAM      In July 1919, a 35 feet breach occurred between sluice gates and right end, according to 1922 dam inspection report in microfiche file of N.J.D.E.P.  
DESCRIPTION  
REPORTS

MAINTENANCE      None were available.  
OPERATION  
RECORDS

Barbour Mill Dam

ITEM	REMARKS
SPILLWAY PLAN	None were available.
SECTIONS	None were available.
DETAILS	None were available.
OPERATING EQUIPMENT PLANS & DETAILS	None were available.

CHECK LIST  
HYDROLOGIC AND HYDRAULIC DATA  
ENGINEERING DATA

0.9 square mile of glaciated terrain  
DRAINAGE AREA CHARACTERISTICS: partially developed and partially woodland.  
ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 281.0 (50 acre-feet)  
ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not Applicable  
ELEVATION MAXIMUM DESIGN POOL: Not Applicable  
ELEVATION TOP DAM: 281.9  
CREST: \_\_\_\_\_

- a. Elevation 280.8
- b. Type Flashboards with stone masonry outlet culverts
- c. Width One (1) five feet main section, one (1) 3.2 feet millrace section
- d. Length Not Applicable
- e. Location Spillover Right center of dam
- f. Number and Type of Gates None

OUTLET WORKS: \_\_\_\_\_

- a. Type Two (2) 30 inch corrugated metal pipes
- b. Location 25 feet north of main inlet
- c. Entrance inverts 281.2
- d. Exit inverts 276.9
- e. Emergency draindown facilities Can be accomplished by removal of flashboards at stone masonry culvert inlets.

HYDROMETEOROLOGICAL GAGES: None

- a. Type \_\_\_\_\_
- b. Location \_\_\_\_\_
- c. Records \_\_\_\_\_

MAXIMUM NON-DAMAGING DISCHARGE Not available

NOTE: Pool elevation was determined from U.S.G.S. Paterson, New Jersey 7.5 Minute Topographic Quadrangle. This pool elevation was used as the reference elevation for the Phase I Inspection.

Name of Dam: Barbour Mill Dam

APPENDIX C

HYDRAULIC/HYDROLOGIC CALCULATIONS



MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

Subject Barbour Mill Pond S.O. No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Drawing No. \_\_\_\_\_  
Computed by \_\_\_\_\_ Checked by \_\_\_\_\_ Date \_\_\_\_\_

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MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280

Beaver, Pa. 15009

Subject N.J. DAM INSPECTION

S.O. No. \_\_\_\_\_

BARBOUR MILL PONDSheet No. 1 of 22DEPTH VS. DURATION COMPS

Drawing No. \_\_\_\_\_

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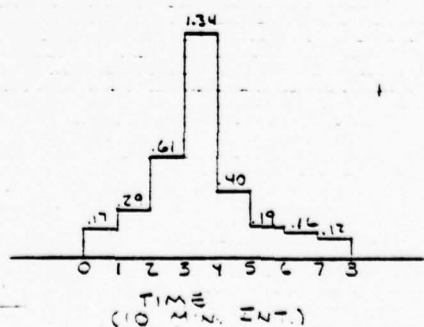
①

DURATION	DEPTH (IN)
5 MIN	.87
10 MIN	1.34
15 MIN	1.69
30 MIN	2.35
1 HR	3.00
2 HR	3.73
3 HR	4.21
6 HR	5.24
12 HR	6.28
24 HR	7.26

DRAINAGE AREA = .86 MI<sup>2</sup>  
ADJUSTMENT FACTOR = 1.00

②

DURATION	Δ (IN.)
10 MIN	1.34
20	.61
30	.40
40	.29
50	.19
60	.17
70	.16
80	.12

 $T_c = 1.24 \text{ HRS} = 74.4 \text{ MINS} \approx 75 \text{ MIN}$ 

MICHAEL BAKER, JR., INC.  
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Box 280  
Beaver, Pa. 15009

Subject NI DAM INSPECTION

S.O. No. \_\_\_\_\_

BARBOUR MILL POND

Sheet No. 2 of 22

DEPTH VS. DURATION CURVE

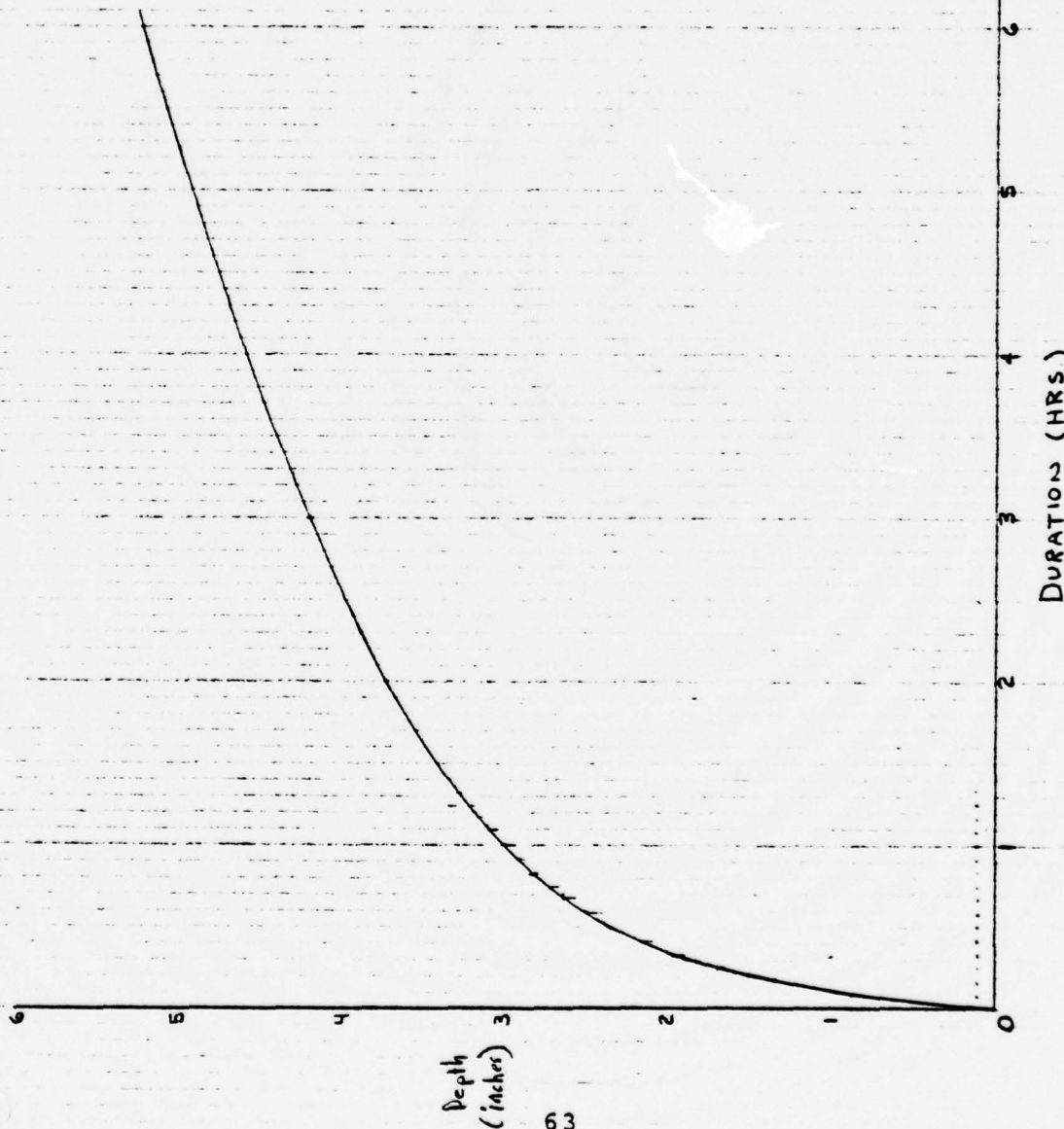
Drawing No. \_\_\_\_\_

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Subject PARBOUR POND

S.O. No. \_\_\_\_\_

Sheet No. 4 of 22

CN NUMBER COMPUTATIONS

Drawing No. \_\_\_\_\_

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Date 07/22/78

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LAND USE	SQ. IN.	SOIL CLASS	%	CURVE NO.	PRODUCT
WOODS	3.03	B	49.3	60	2958.0
MEDOWS	0.84	B	13.7	58	794.6
WATER SURFACE	0.52	B	8.5	100	850.0
RESIDENTIAL 1 ACRE LOTS	0.52	B	8.5	68	578.0
BAREN STRIP	1.18	B	19.1	80	1528.0
MINE PERMI- ABLE					
ROADS					
HARD	0.06	B	0.9	98	88.2
TOTAL	6.15		100.0		6796.8

$$CN = 6796.8 / 100 = 68$$



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SURFACE AREA AT NORMAL POOL :

Computed by A-2

Sheet No. 3 of 22

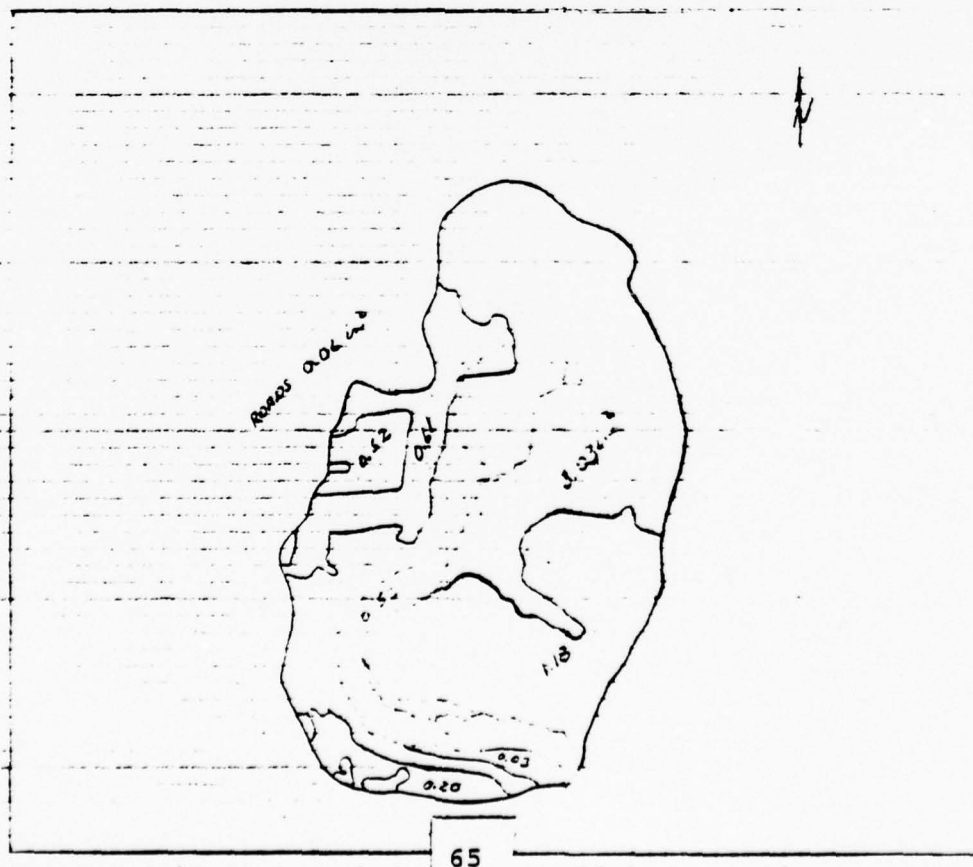
Drawing No.

Date 07/22/78

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1) SURFACE AREA BARBOUR POND, PLANIMETERED ON USGS 7.5 MINUT  
QUAD SCALE 1" = 2000' 0.15 in 13.77 AC

2) DRAINAGE AREA BARBOUR POND 6.15 in 0.86 mi<sup>2</sup> 564.75 AC



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Subject BARBOUR MILL POND  
TIME OF CONCENTRATION

S.O. No. 13143-01-22A

Sheet No. 5 of 22

Drawing No. \_\_\_\_\_

Computed by TWS Checked by JRM

Date 7-21-78

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COURSE A (Design of Small Dams P. 70)

1 to 2  $\frac{620-410}{1590} = 0.14$  14% slope

woodland upper portion  $V = 3.5$  ft/sec 7.5 min

2 to 3  $\frac{410-405}{700} = 0.01$  1% slope

pasture upper portion  $V = 1.5$  ft/sec 8.0 min

3 to 4  $\frac{405-317}{1450} = 0.06$  6% slope

natural channel not well defined  $V = 3.0$  ft/sec 8.1 min

4 to 4 23.6 min

COURSE B

1 to 2  $\frac{430-410}{1450} = 1.4\%$  slope

woodland upper portion  $V = 1.3$  ft/sec 17.9 min

2 to 3  $\frac{410-400}{1800} = 1.0\%$   $V = 1.0$

not well defined ch.

16.7 min

3 to 4  $\frac{400-317}{1200} = 7\%$  slope  $V = 2.5$

8.0

woodland upper portion not well defined

4 to 4 42.6 min

from 4 to Lake 3.8

$T_c = \left( \frac{11.9 \cdot L}{K} \right)^{0.775}$

$= \left[ \frac{11.9(1.90)^{0.775}}{32} \right]$

$= 0.53 \text{ hrs} = 31.8 \text{ min}$

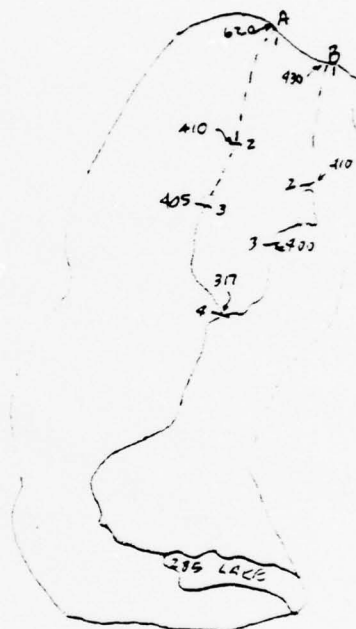
COURSE A to Lake = 23.6 min + 31.8 min = 55.4 = 0.92 hr

COURSE B to Lake = 42.6 min + 31.8 min = 74.4 = 1.24 hr

COMPARISON

Using TR-55  $\frac{620-235}{7930} = 4\%$   $CN = 60$  Figure 3.3  $L = 1.1$   $T_c = 1.8 \text{ hrs}$

USE  $T_c = 1.24 \text{ hrs}$



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Subject BARBOUR MILL Pond S.O. No. \_\_\_\_\_  
Duration of Time to peak Sheet No. 6 of \_\_\_\_\_  
Drawing No. \_\_\_\_\_  
Computed by TWS Checked by JRM Date 7-22-78

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'Design of Small Dams' p. 74  
Using a  $T_c = 1.24$  hrs

$$D \approx \frac{1}{5} T_c = \frac{1}{5} (1.24) = 0.25 \text{ hr} = 15 \text{ min}$$

try  $D = 15 \text{ min}$   $T_p = D/2 + 0.6 T_c = 0.25/2 + 0.6(1.24) = 0.869 = 52 \text{ min}$

do not yield enough definition of the rising curve of the unit graph

try  $D = 10 \text{ min}$

$$T_p = 0.1667/2 + 0.6(1.24) = 0.83 \text{ hr} = 50 \text{ min}$$

WR  $D = 10 \text{ min}$   $T_p = 50 \text{ min}$   $T_c = 1.24 \text{ hr} = 74 \text{ min.}$

$$q_p = \frac{484 A Q}{T_p} = \frac{484 (0.9) (1)}{0.83} = 523 \text{ cfs}$$

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Subject Adjusted Unit Hydrograph  
Barbour Mill Pond

S.O. No. \_\_\_\_\_

Sheet No. 7 of 22

Drawing No. \_\_\_\_\_

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Time	Flow	Flow = $q_p \times SCS$ CURVILINEAR HYDROGRAPH ORDINATES was adjusted for 1"
0	0	
10	33.92	
20	145.29	
30	311.33	
40	461.91	
50	518.83	
60	477.36	
70	337.16	
80	290.51	
90	217.43	
100	166.04	
110	124.53	
120	93.40	
130	67.45	
140	50.35	
150	39.92	
160	29.25	
170	19.87	
180	12.97	
190	9.36	
200	7.26	
210	5.70	
220	4.15	
230	2.89	
240	2.07	
250	1.04	
260	0.52	
270	0.26	
280	0	
290	0	
300	0	
310	0	
320	0	
330	0	
340	0	
350	0	
360	0	

$$\frac{3484.78 \text{ cfs}}{\text{sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{1 \text{ mi}^2}{(5280)^2 \text{ ft}^2} \times 10 \text{ min} \times \frac{12 \text{ in}}{\text{ft}} \times \frac{1}{0.9 \text{ mi}^2} = 0.999 \text{ in.}$$



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Subject BARBOUR mill POND

S.O. No. \_\_\_\_\_

Spillway Rating

Sheet No. 8 of 22

① Inlet To Large Arch

Drawing No. \_\_\_\_\_

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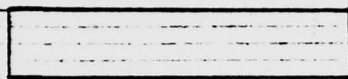
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T 00

282.3



281.1

280.8

5'

Flow is by Weir and Orifice

$$\text{Weir } Q = CLH^{3/2}$$

$$\text{Orifice } Q = \frac{2}{3} L \sqrt{2g} (H_2^{3/2} - H_1^{3/2}) \quad (\text{For orifice under low Head})$$

Kings "Hand book of Hydraulics" pg 4-5

Elev. (msl)	C <sub>(weir)</sub>	L	H <sub>weir</sub>	H <sup>3/2</sup>	Q <sub>weir</sub> (cfs)	H <sub>1</sub>	H <sub>2</sub>	Q <sub>orifice</sub> (cfs)
280.8	3.3	5	0	0	0			
280.9	3.3		0.1	.03	0.5			
281.0	3.3		0.2	.09	1.5			
281.1						0.0	.3	4.4
281.2						0.1	.4	5.9
281.3						0.2	.5	7.1
281.4						0.3	.6	8.0
281.9 ← minimum top of dam						0.8	1.1	11.7
282.0						0.9	1.2	12.3
282.3 ← maximum top of dam						1.2	1.5	14.0
283.4						2.3	2.6	18.8
284.4						3.3	3.6	22.4
284.9						3.8	4.1	23.9 ✓

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Subject BARBOUR MILL POND

S.O. No. \_\_\_\_\_

Sheet No. 9 of 22

(2) Inlet To large arch

Drawing No. \_\_\_\_\_

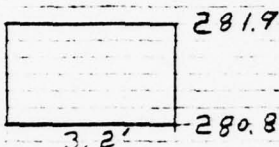
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F.O.D. 282.3



Flows determined by equations used on previous page

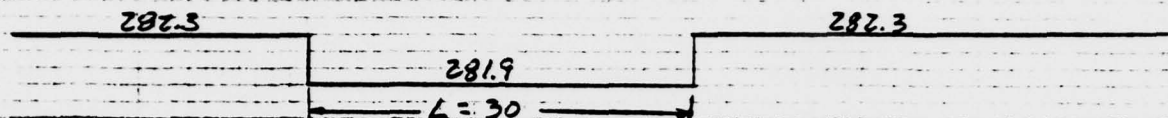
Elev.	C (Weir)	L (Weir)	H	H <sup>3/2</sup>	Q <sub>(Weir)</sub> (CFS)	H <sub>1</sub>	H <sub>2</sub>	Q <sub>Orifice</sub> (CFS)
280.8	3.3	3.2	0	0	0			
280.9			0.1	.03	.3			
281.0			0.2	.09	1.0			
281.1			0.3	.16	1.7			
281.2			0.4	.25	2.6			
281.3			0.5	.35	3.7			
281.4			0.6	.46	4.9			
281.9	minimum top of dam					0.0	1.1	19.8
282.0						0.1	1.2	22.0
282.3						0.4	1.5	27.1
283.4						1.5	2.6	40.3
284.4						2.5	3.6	49.3
284.9						3.0	4.1	53.2

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Subject NS DAM INSPECTIONS S.O. No. \_\_\_\_\_  
BARBOUR MILL DAM Sheet No. 10 of 22  
③ WEIR FLOW AT LOW POINT Drawing No. \_\_\_\_\_  
Computed by TWS Checked by JRM Date 8/28/78

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$Q = CLH^{3/2}$  using  $C = 2.65$  for a broadcrested weir ( $b \approx 15'$ )  
assuming an average coefficient

ELEV	H	$H^{3/2}$	C	L (ft)	Q (cfs)
281.9	0	0	2.65	30	0 ← TOP OF DAM
282.0	0.1	0.03			2
282.1	0.2	0.09			7
282.2	0.3	0.16			13
282.3	0.4	0.25			20
282.4	0.5	0.35			28
282.9	1.0	1.00			80
283.4	1.5	1.84			146
283.5	1.6	2.02			161
283.9	2.0	2.83			225
284.4	2.5	3.95			314
284.9	3.0	5.20	2.65	30	413

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Subject BARBOUR MILL DAM

S.O. No. \_\_\_\_\_

Sheet No. 11 of 22

CD Remaining Wall

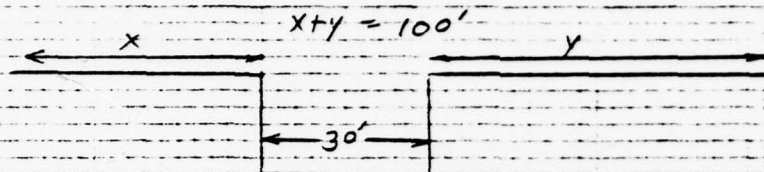
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$$Q = CLH^{3/2}$$

$C = 2.65$  (FOR BROADCRESTED WEIR  
 $L = 100'$  OF APPROX. 15 FEET)

ELEV.	H	$H^{3/2}$	C	L <sup>ft</sup>	Q <sup>cfs</sup>
282.3	0	0	2.65	100	0
282.4	.1	.03			8
282.9	.6	.46			122
283.4	1.1	1.15			305
283.9	1.6	2.02			535
284.4	2.1	3.04			806
284.9	2.6	4.19			1110



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Subject N.J. Dam Inspection  
Barbours Mill Dam  
③ 2-30" CMP's  
Computed by RCH

S.O. No. \_\_\_\_\_  
Sheet No. 12 of 22  
Drawing No. \_\_\_\_\_  
Date 2/23/78

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283.5

EL 121.0

$L = 30'$

$S = 0.143 \frac{ft}{ft}$

$n = 0.024$

$A_T = 4.91 \frac{ft^2}{ft}$

$R_T = 0.675$

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

ELV.	D(ft)	A(ft <sup>2</sup> ) <sup>1</sup>	$R^2$	$R^{2/3}$	$S^{1/2}$	Q(CFS)	LQ
281.0	0.0	1	0	0	0.379	(at grade pool)	
281.1	0.1	0.066	0.065	0.162		0.3	1
281.2	0.2	0.184	0.128	0.254		1.1	2
281.3	0.3	0.334	0.188	0.325		2.6	3
281.4	0.4	0.507	0.248	0.395		4.7	9
281.9	0.9	1.591	0.495	0.626	(top of dam)	23.4	41
282.0	1.0	1.834	0.535	0.659		28.4	51
282.1	1.1	2.080	0.573	0.690		33.7	55
282.2	1.2	2.329	0.612	0.718		39.3	79
282.3	1.3	2.581	0.640	0.743		45.1	90
282.4	1.4	2.831	0.670	0.766		51.0	102
282.9	1.9	4.000	0.755	0.829		77.9	156
283.4	2.4	4.844	0.796	0.793		90.3	151

<sup>1</sup> Table 7-4 King's Handbook of Hydraulics

<sup>2</sup> Table 7-5 King's Handbook of Hydraulics

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Subject N.J. Dam Inspection S.O. No. \_\_\_\_\_  
Barbour Mill Dam Sheet No. 13 of 22  
(5) 2-30" CMP's (submerged) Drawing No. \_\_\_\_\_  
Computed by RCH Checked by JRM Date 8/28/73

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Submerged Pipes:

$$Q = CA \sqrt{2gh}$$

$C = 0.65$  From King's Handbook of Hydraulics  
(Pg. 4-37 Table 4-11)

Elev. (ft)	C	A (ft <sup>2</sup> )	h (ft)	$\sqrt{2gh}$	Q (cfs)
133.5	0.65	4.91	4.50	11.0	109
133.9	0.65	4.91	4.90	11.8	114
134.4	0.65	4.91	5.40	13.6	119
134.9	0.65	4.91	5.90	15.5	124



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Subject Barbours Mill Dam  
Stage - Discharge

S.O. No. \_\_\_\_\_  
Sheet No. 14 of 22  
Drawing No. \_\_\_\_\_  
Date 3/29/73

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ELEV. (ft.)	Q <sub>1</sub> (cfs)	Q <sub>2</sub> (cfs)	Q <sub>3</sub> (cfs)	Q <sub>4</sub> (cfs)	Q <sub>5</sub> (cfs)	Q <sub>TOTAL</sub> (cfs)
280.5	0	0				0
280.9	1	0				1
281.0	2	1			0	3
281.1	4	2			1	7
281.2	6	3			2	11
281.3	7	4			3	14
281.4	8	5			4	17
281.9	12	10	2		47	71
282.0	12	22	2		57	93
282.3	14	27	20	0	90	151
283.4	19	40	146	305	114	624
284.4	22	49	314	306	119	1310
284.9	24	53	415	1110	124	1726

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Subject BARBOUR MILL DAM  
ELEVATION VS. DISCHARGE

S.O. No. \_\_\_\_\_

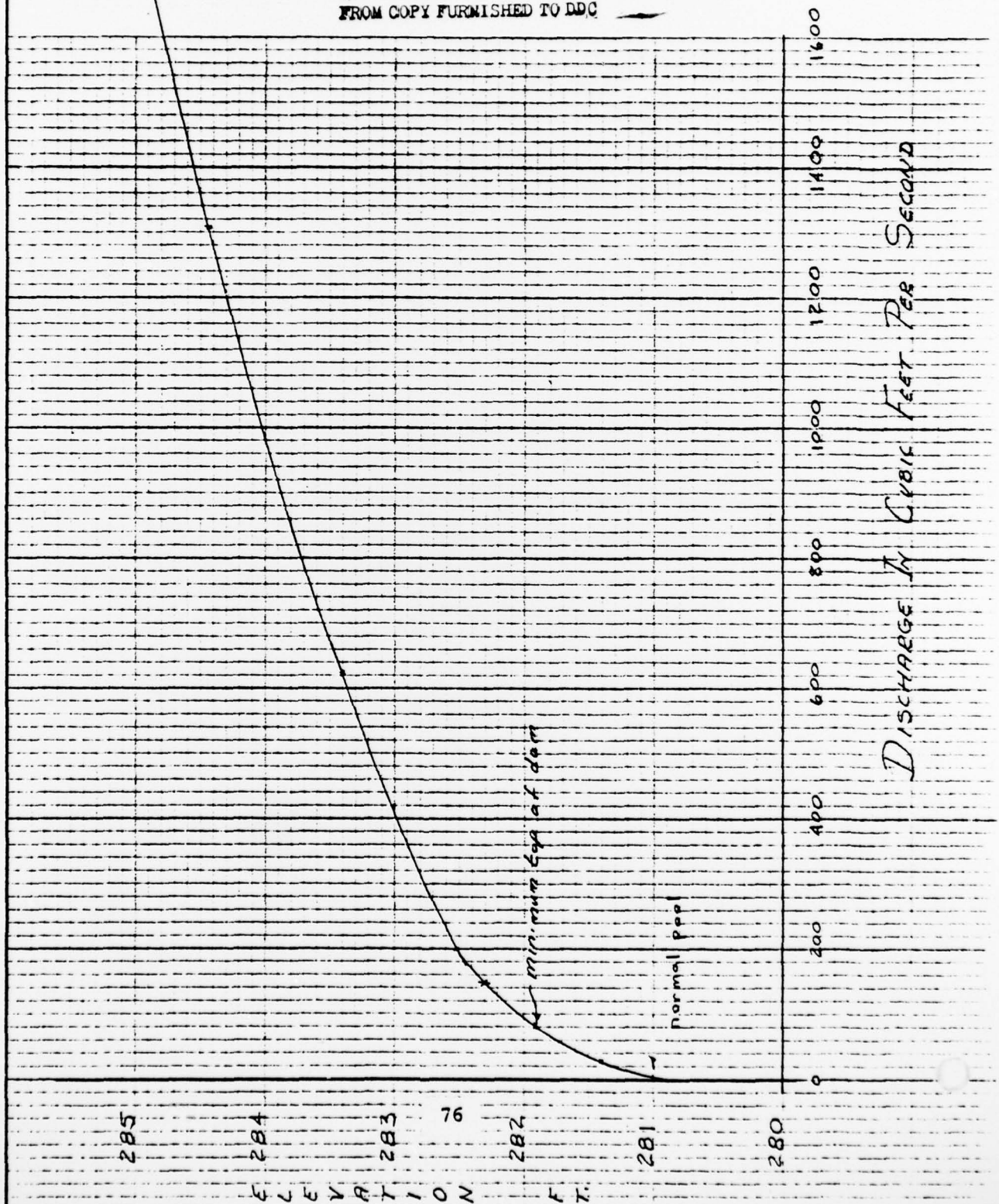
Sheet No. 15 of 22

Drawing No. \_\_\_\_\_

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Subject BARBOUR POND

STAGE VS AREA CURVE

S.O. No. \_\_\_\_\_

Sheet No. 16 of 12

Drawing No. \_\_\_\_\_

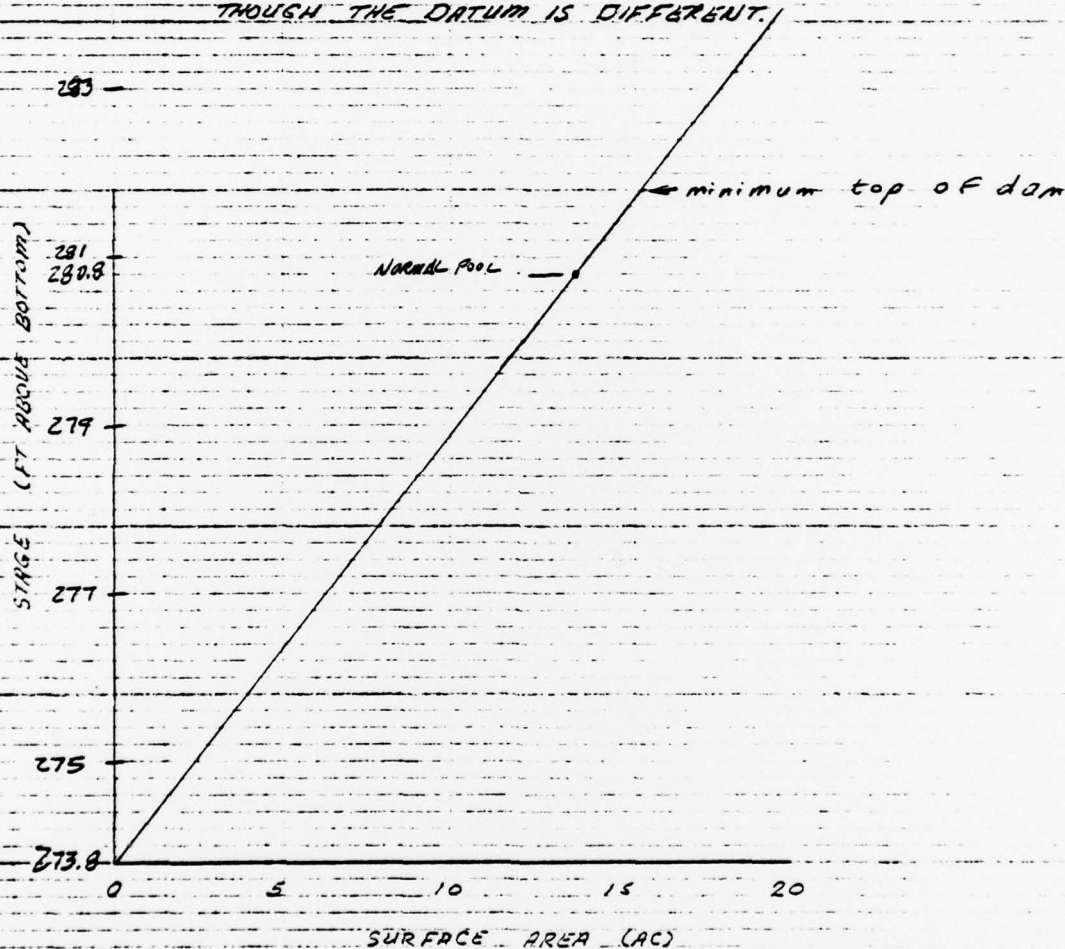
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Date 6/22/78

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NOTE: MINIMUM ELEVATION OF DAM UNKNOWN, THEREFOR BOTTOM  
WILL BE ASSUMED TO BE ELEVATION 273.8. HOWEVER,  
HEIGHT OF DAM & HEIGHT OF SPILLWAY ARE KNOWN ABOVE  
BOTTOM, THEREFOR, THE COMPUTATIONS WILL BE THE SAME  
THOUGH THE DATUM IS DIFFERENT.



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Subject BARBOUR POND

S.O. No. \_\_\_\_\_

ELEVATION VS STORAGE COMPUTATIONS

Sheet No. 17 of 22

Drawing No. \_\_\_\_\_

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Date 27/22/78

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ELEVATION	SURFACE AREA	AVERAGE SURFACE AREA	INCREMENTAL STORAGE (ACRE-FT)	CUMULATIVE STORAGE (ACRE-FT)
280.8	13.8			1.3
280.9	14.0	13.9	1.4	1.4
281.0	14.2	14.1	1.4	2.8
281.1	14.4	14.3	1.4	4.2
281.2	14.6	14.5	1.4	5.6
281.3	14.8	14.7	1.5	7.1
281.4	15.0	14.9	1.5	8.6
281.5	15.2	15.1	1.5	10.1
281.6	15.3	15.2	1.5	11.6
281.7	15.5	15.4	1.5	13.1
281.8	15.7	15.6	1.6	14.7

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Subject BARBOUR Pond

ELEVATION VS STORAGE

S.O. No. \_\_\_\_\_

Sheet No. 18 of 22

Drawing No. \_\_\_\_\_

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ELEVATION	SURFACE AREA	AVERAGE SURFACE AREA	INC. STORAGE (AC-FT)	CUM. STORAGE (AG-FT)
281.8	15.7	15.2	1.4	1.7
282.0	14.1	15.9	3.2	16.3 @ 81
282.2	14.5	16.3	3.3	12.9
282.4	14.7	16.6	1.7	21.2
282.6	14.9	16.8	1.7	22.9
282.8	17.3	17.1	3.42	24.6
283.0	17.7	17.5	3.50	28.0
283.3	18.7	18.2	9.10	31.5
				40.6

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Subject BARBOUR MILL

ELEV. W. Storage

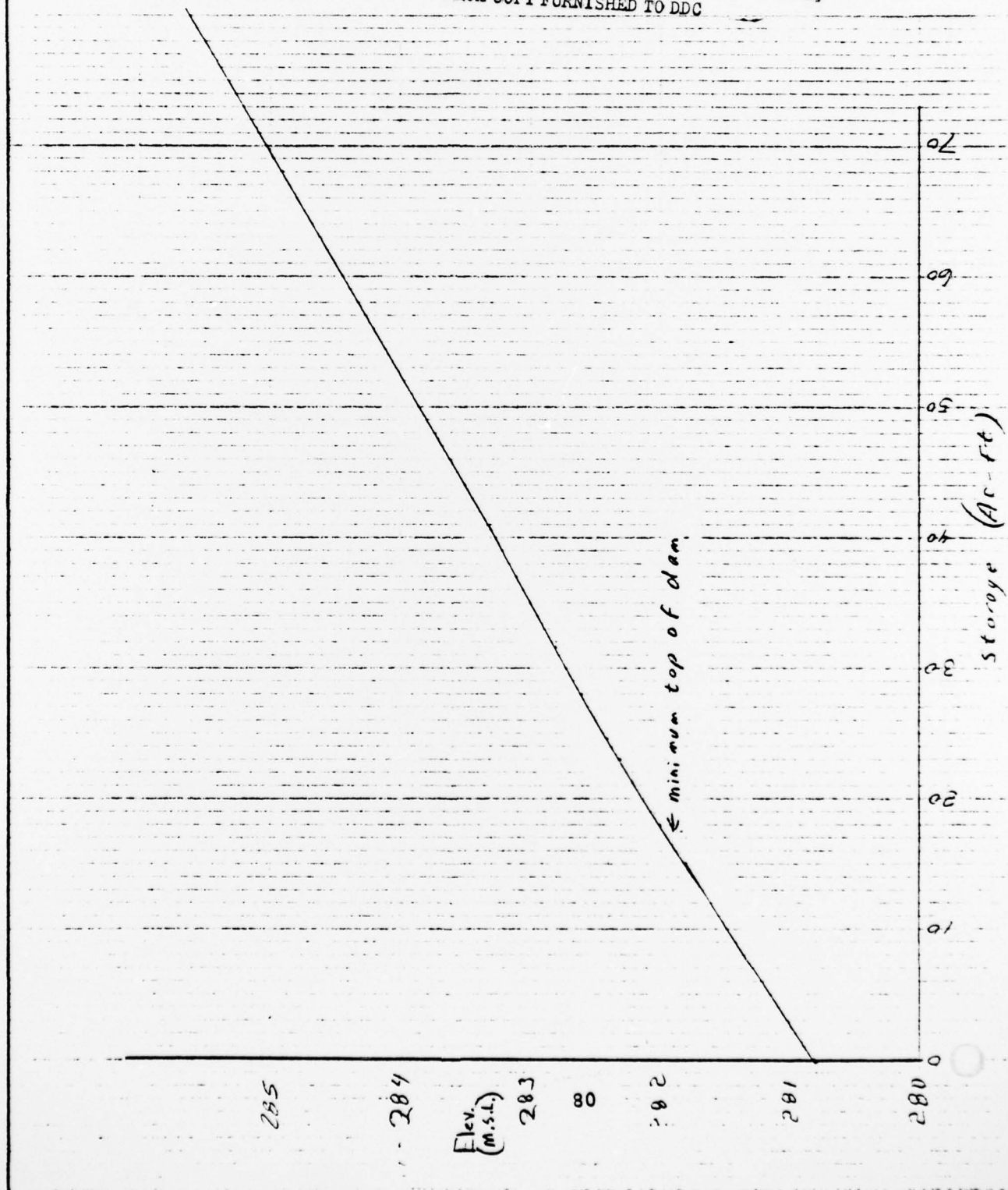
S.O. No. \_\_\_\_\_

Sheet No. 19 of 22

Drawing No. \_\_\_\_\_

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Box 280  
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Subject BARBOUR MILL

Discharge vs. Storage

Curve

Computed by JRM

Checked by \_\_\_\_\_

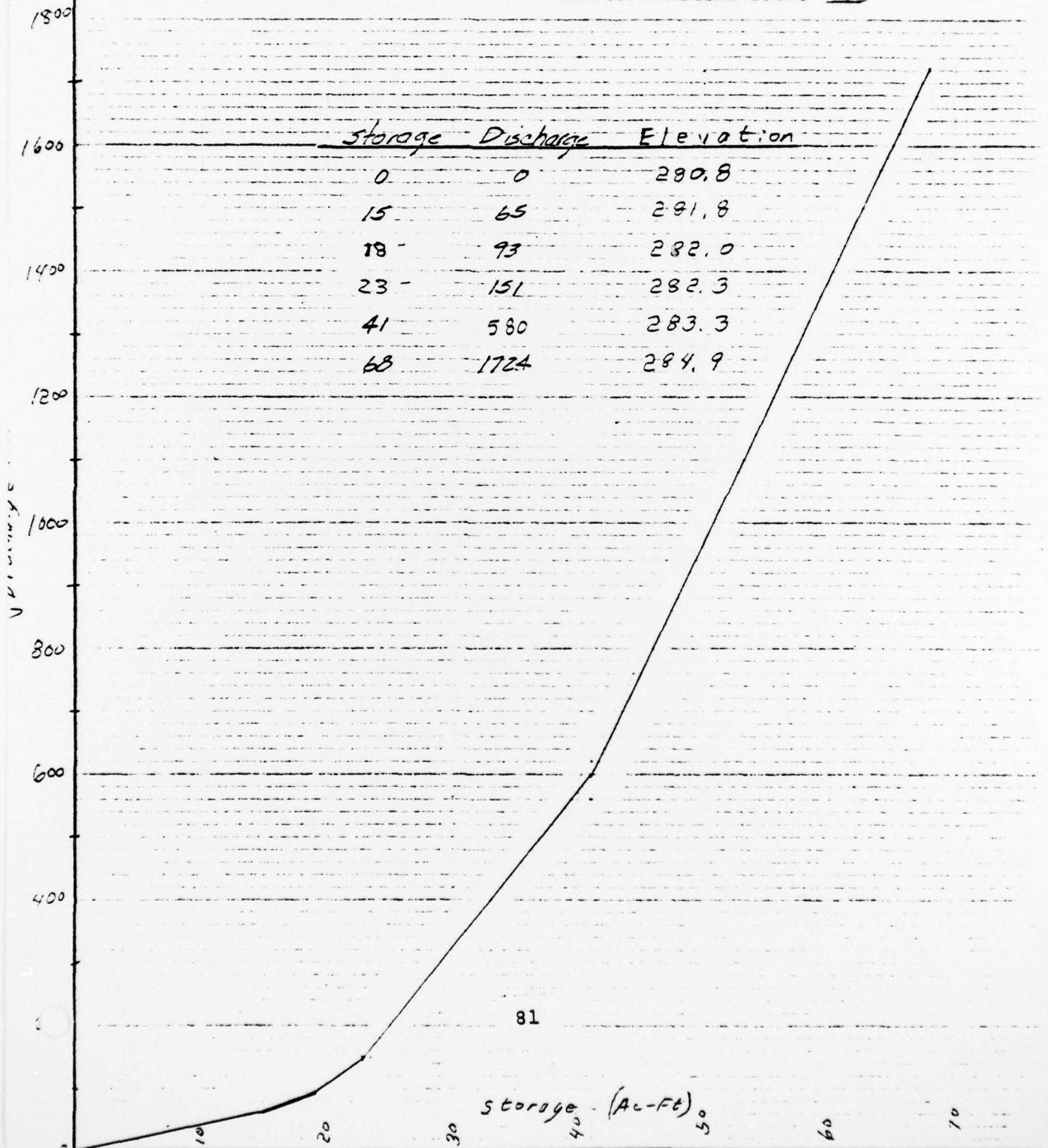
S.O. No. \_\_\_\_\_

Sheet No. 20 of 22

Drawing No. \_\_\_\_\_

Date 8-30-73

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Subject BARBOUR MILL POND

S.O. No. \_\_\_\_\_

DRAW DOWN

Sheet No. 21 of 22

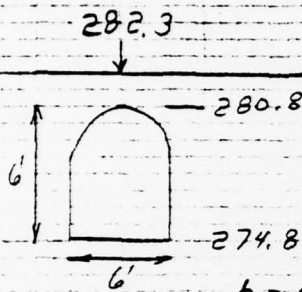
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Date 8-30-73

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Normal pool  
at 281.0

Note: Assumed a 6x6 rectangular section  
so as to use ES-24.

$$V_c = \sqrt{\frac{g Q_c}{b}}$$

From nomograph ES-24 SCS Sect 5 'Hydraulics'

W.S. ELEV	$d_c$	$\frac{Q_c}{b}$	$Q_c$	$\frac{V_c^2}{2g}$	Elev. Reservoir
280.8	6	8.3	498	2.99	283.8
280.5	5.7	7.7	462	2.84	283.3
280.0	5.2	6.6	396	2.57	282.6
279.0	4.2	4.9	294	2.10	281.1
278.0	3.2	3.2	192	1.58	279.6
277.0	2.2	18.5	111	1.10	278.1
276.0	1.2	7.5	45	0.60	276.6
275.5	0.7	3.3	20	0.35	275.9

MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

Subject BARBOUR MILL POND S.O. No. \_\_\_\_\_  
DRAWDOWN Sheet No. 22 of 22  
Drawing No. \_\_\_\_\_  
Computed by JRM Checked by \_\_\_\_\_ Date 8-30-78

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①	②	③	④	⑤	⑥	⑦
Elev. Res.	Avail. Stor. (AC-FT)	Aug. Storage	Discharge Actual (CFS)	Discharge Aug. (CFS)	Aug. Discharge (CFS)	Drawdown Days
283.8	99*	95	498	480	952	0.10
283.3	91*	85	462	429	851	0.10
282.6	79*	66.5	396	345	684	0.10
281.1	54*	47.5	294	243	482	0.10
279.6	41	34.5	192	151.5	301	0.11
278.1	28	21.5	111	78	155	0.14
276.6	15	12	45	32.5	64	0.19
275.9	9		20			
274.8	0	4.5	0	10	20	0.23

\* At normal pool, EL. 280.8, storage is 50 AC-FT. The total storage above normal pool was estimated by the addition of 50 AC-FT to the storage above normal pool.

1.07 DAYS

Assumed all flashboards were removed, before drawdown begins.

\*\*\*\*\*  
 HEC-1 VERSION DATED JAN 1973  
 \*\*\*\*\*

BARBOUR MILL PUND  
 NEW JERSEY  
 SCS CURVILINEAR HYDROGRAPH

JOB SPECIFICATION

NQ NHR NMN IDAY INK IMIN PETRC IPRT IPRT NSTAN  
 48 0 10 0 0 0 0 0 0 0  
 JOFIR NMI  
 3 0

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SUB-AREA RUNOFF COMPUTATION

ISTAQ ICOMP IECON ITAPE JPLI JPRT INAME  
 1 0 0 0 2 1 0

HYDROGRAPH DATA

IHYDG IUHG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL  
 0 -1 0.90 0.0 0.0 0.0 0.0 0.0 0 0 0

PRECIP DATA

NP STORM DAK  
 8 0.0 0.0  
 PRECIP PATERN

0.17 0.29 0.61 1.34 0.40 0.19 0.16 0.12

LOSS DATA

STRKP DLTKR RTIOL ERAIN STRKS RTIOL STRTL CNSTL ALSMX RTIMP  
 0.0 0.0 1.00 0.0 0.0 1.00 1.00 0.20 0.0 0.0

GIVEN UNIT GRAPH, NUHQ= 36

39. 145. 311. 462. 519. 477. 389. 291. 218. 166.  
 125. 93. 67. 39. 25. 17. 13. 10. 7.  
 6. 4. 3. 2. 1. 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. 0. 0.

UNIT GRAPH TOTALS 3485. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

SIRTIQ= 0.0 QKCSN= 0.0 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.17	0.00	0.
2	0.29	0.00	0.
3	0.61	0.07	3.
4	1.34	1.31	60.
5	0.40	0.37	225.
6	0.19	0.16	491.
7	0.16	0.13	780.
8	0.12	0.09	949.
9	0.0	0.0	964.
10	0.0	0.0	870.
11	0.0	0.0	717.
12	0.0	0.0	574.



13	0.0	0.0	0.0	441.
14	0.0	0.0	0.0	559.
15	0.0	0.0	0.0	251.
16	0.0	0.0	0.0	105.
17	0.0	0.0	0.0	139.
18	0.0	0.0	0.0	105.
19	0.0	0.0	0.0	78.
20	0.0	0.0	0.0	52.
21	0.0	0.0	0.0	38.
22	0.0	0.0	0.0	28.
23	0.0	0.0	0.0	20.
24	0.0	0.0	0.0	15.
25	0.0	0.0	0.0	11.
26	0.0	0.0	0.0	8.
27	0.0	0.0	0.0	6.
28	0.0	0.0	0.0	4.
29	0.0	0.0	0.0	2.
30	0.0	0.0	0.0	1.
31	0.0	0.0	0.0	0.
32	0.0	0.0	0.0	0.
33	0.0	0.0	0.0	0.
34	0.0	0.0	0.0	0.
35	0.0	0.0	0.0	0.
36	0.0	0.0	0.0	0.
37	0.0	0.0	0.0	0.
38	0.0	0.0	0.0	0.
39	0.0	0.0	0.0	0.
40	0.0	0.0	0.0	0.
41	0.0	0.0	0.0	0.
42	0.0	0.0	0.0	0.
43	0.0	0.0	0.0	0.
44	0.0	0.0	0.0	0.
45	0.0	0.0	0.0	0.
46	0.0	0.0	0.0	0.
47	0.0	0.0	0.0	0.
48	0.0	0.0	0.0	0.
SUM	3.28	2.13	7352.	

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
964.	204.	153.	153.	7351.
CFS	2.11	2.11	2.11	2.11
INCHES	101.	101.	101.	101.
AC-FT				

•DVA•

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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# RUNOFF SUMMARY, AVERAGE FLOW

HYDROGRAPH AT  
ROUTED TO

PEAK  
964.  
650.

6-HOUR  
204.  
191.

24-HOUR  
153.  
147.

72-HOUR  
153.  
147.

AREA  
0.90  
0.50



ED  
78